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WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

TM-110300
SERVICE MANUAL
VOLUME 2

SERIES 808
ELECTRIC POWER DEMAND ANALYZER

Note: Refer to Volume 1 of TM-110300 for Installation and Operating Instructions.

See Oppositie Side Relative to Proprietary Rights.

1 November 1983
(Rev. 1 Nov. 1987)
(Rev. 1 Dec. 1989)

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IMPORTANT! CALIBRATION INTERVAL

The recommended calibration interval for this unit is once every **12 MONTHS.**

We recommend that you return the unit to the factory for calibration. If you decide to do so, first contact Dranetz Service Corp. to obtain an authorization number.

Telephone Number: (201) 287-3680
Telex Number: 499-7808
TWX Number: (710) 997-9553
FAX Number: (201) 248-9240
Cable: DRANETZ

Then fill out the Repair/Service Order form enclosed in this manual and ship it along with the unit to Dranetz Service Corp. (If this form is missing, ask Dranetz Service Corp. for a replacement.)

BATTERY PACK REPLACEMENT

This unit also contains an internal battery pack. For optimal use and reliability, we recommend that you have the battery pack replaced once every **2 YEARS.**

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SECTION IV

THEORY OF OPERATION

4.1 INTRODUCTION

This volume contains maintenance instructions for the Series 808 Electric Power Demand Analyzer. For operating instructions relative to this unit, refer to Volume 1 of this manual. Included in the following pages are the Theory of Operation, Maintenance and Adjustment, Replaceable Parts List, and Schematic Diagrams and Assembly Drawings.

4.2 MAINFRAME BLOCK DIAGRAM DESCRIPTION

The system may be broken up into smaller functional blocks as shown in figure 4-1. Each of these blocks performs a necessary system function. The Main Processor board operates and coordinates the interoperation of the various blocks. This board also stores accumulated data and provides the necessary power supplies to run the Unit.

Data can be transmitted in either direction between the Main Processor board, Keyboard/Display and the Analog board. The data sent to the Keyboard/Display controls what is to be displayed, the audio alarm status (ON or OFF) and which LED is to be on. Data sent from the keyboard informs the Main Processor which key the user depressed. The Printer operates from data supplied by the Main Processor. This data determines what is printed and how the printer paper is moved.

The battery and the Transformer board furnish necessary support for the Main Processor board. The Transformer board provides a low level AC voltage to run the battery charger on the Main Processor board while the battery receives charging current from the Main Processor power section and furnishes the Main Processor supplies with the necessary voltage and current.

The Analog board supplies the Main Processor with a continuous update of monitored parameters, either from analog or pulse inputs.

4.3 KEYBOARD/DISPLAY A1

The Keyboard/Display enables communication between the 808 user and the Main Processor board. More specifically, the board prompts LED indicators, and displays information and data requested by the user.

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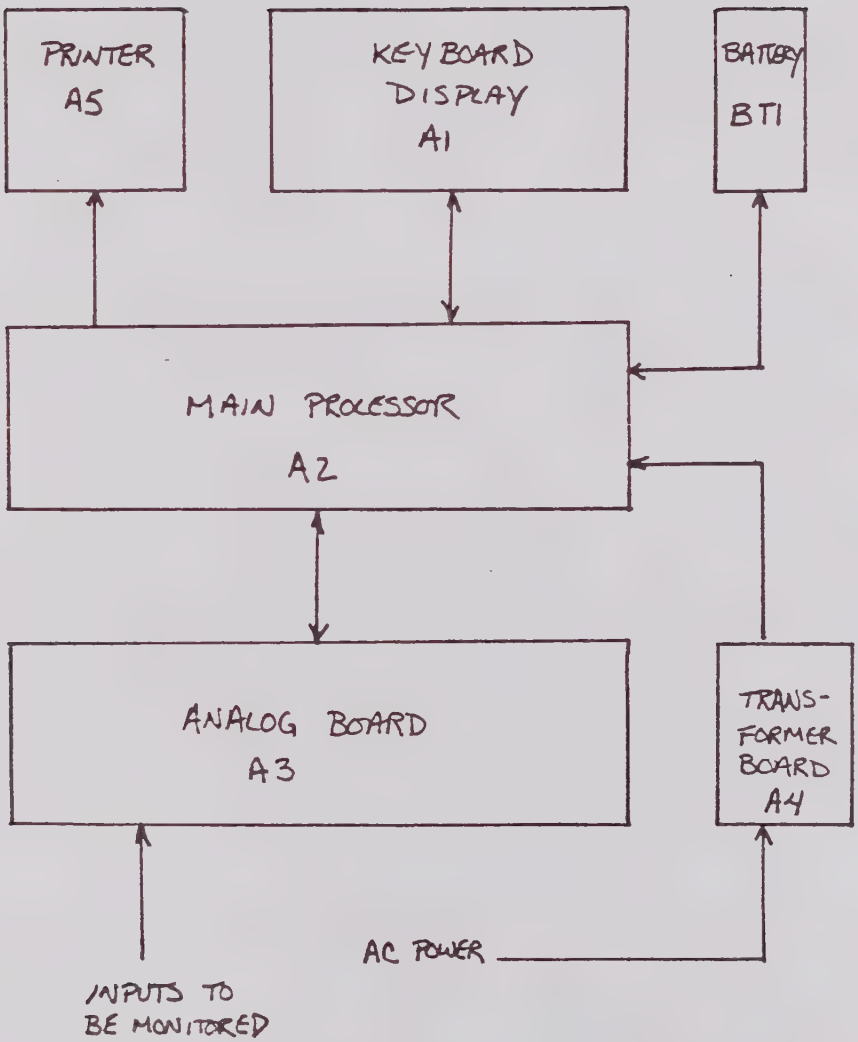

Figure 4-1. 808, Block Diagram

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4.3.1 Block Diagram Description (See figure 4-2.)

The Main Processor board controls the keyboard via interface connector J1 on the keyboard. All data and address bits required for the operation of the board pass through this connector.

The different sections of the keyboard are selected by using a 4-bit code that is fed to decoder U25. These address bits are designated A0, A1, A2, and SEL. The SEL signal must be set low before any part of this board can be accessed by the Main Processor. Once the board is selected, the three address bits determine which of the following is to be addressed:

1) LED latches U20 and driver U19,
2) Keyboard buffer U21,
3) Alarm control (part of U22),
4) Polarity control for LCD display voltages (part of U22),
5) Column control for LCD display U26 and U4-U13, and
6) Row latches for LCD display U14 and U15.

4.3.2 Detailed Description

See figure 7-1 for the schematic diagram of the Keyboard/Display.

4.3.2.1 LED Latches and Drivers U19 and U20

Pin 15 of decoder U25 selects the LED portion of the board. When this section is selected, the data that appears on bits DB0 through DB5 will be clocked into latch U20. Only one of the bits will be high at any given time. U19 sinks the current from the LEDs and R14 through R19 limit the current for these LEDs.

4.3.2.2 Keyboard and Buffer U21

TThe keyboard of the unit consists of a membrane keypad arranged in 7 by 4 matrix. The keypad is connected to the Keyboard/Display via J2. Pins 1, 2, 6 and 11 are the rows; pins 3, 4, 5, 7, 8, 9, and 10 are the column connections of J2. Using latches U14 and U15, each column of the matrix is strobed. When a key is depressed by the user and pin 13 of decoder U25 selects buffer U21, the Main Processor board can determine which key was depressed. Using this data, the processor can act on commands.

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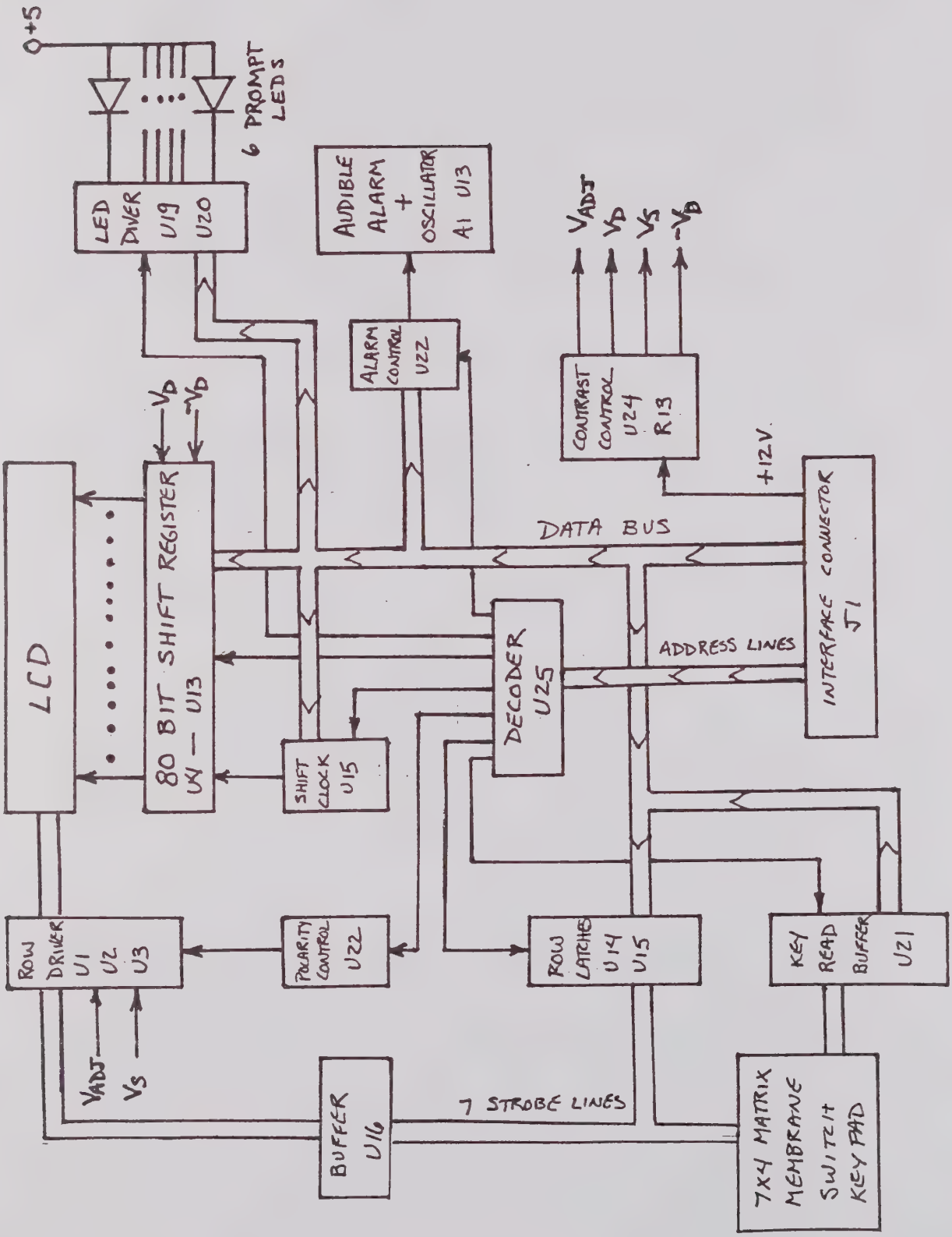

Figure 4-2. Keyboard/Display, Block Diagram

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4.3.2.3 Alarm Control U22

The level at which bit DB0 is set when the alarm control is generated (by pin 10 of decoder U25) determines whether or not alarm oscillator U23 is enabled. When selected, this decoder line clocks the CLK2 input of flip-flop U22. The buffered Q2 output of this flip-flop is then used to control the oscillator. If DB7 is set high, the alarm will be audible; if DB7 is low, the alarm is shut off.

4.3.2.4 Polarity Control for LCD U22

The LCD Display requires an AC waveform such as shown in figure 4-3 to be operated. The other half of flip-flop U22 (CLK1 clock input and Q1 output) is used to latch data from bit DB7 to U3. This function is determined by the level at pin 9 of decoder U25. U3, in turn, controls its own output along with the outputs of U1 and U2. These IC's, when strobed from U16, provide outputs that go from Vs to V_{adj} or ground, depending on the level at which DB7 was latched. After being strobed, the output voltage level returns to a steady state state voltage of Vs.

4.3.2.5 Column Control for LCDs

In order to drive the LCD column segments properly, the column voltages must fall between V_{adj} and ground. This is achieved by U24, R1, R2, R3, R4 and R13. The outputs of U24 are used as the supplies for U4 through U13. These ICs, in turn, drive the columns of the LCD display. (See figure 4-3.) Whenever the column is opposite from row inputs, i.e., the row is at V_{adj} and the column is at -Vd (see figure 4-4), the LCD segment will be dark or visible. If the inputs are in the same direction, the segment will be silver or off. The control and data lines are level-shifted to compensate for the setting of U24. The data on DB0 through DB4 is shifted by U17, RN4 and RN5 and appear at the inputs of shift registers U4-U13. When the Main Processor board selects the column control, the select line at pin 12 of U25 is level shifted by U26, R5 and R7 and is then used to clock data into the display.

4.3.2.6 Row Latches for LCD Display U14 and U15

This section of the Keyboard/Display is used to strobe pulses for both the row drivers of the LCD and the keypad. When selected by the Main Processor, bits DB0 through DB7 are clocked in by the select line from pin 14 of U25. In general, the bits will be at the low level or ground. When a line is to be strobed, the Main Processor sends a high bit to that line and then clears it.

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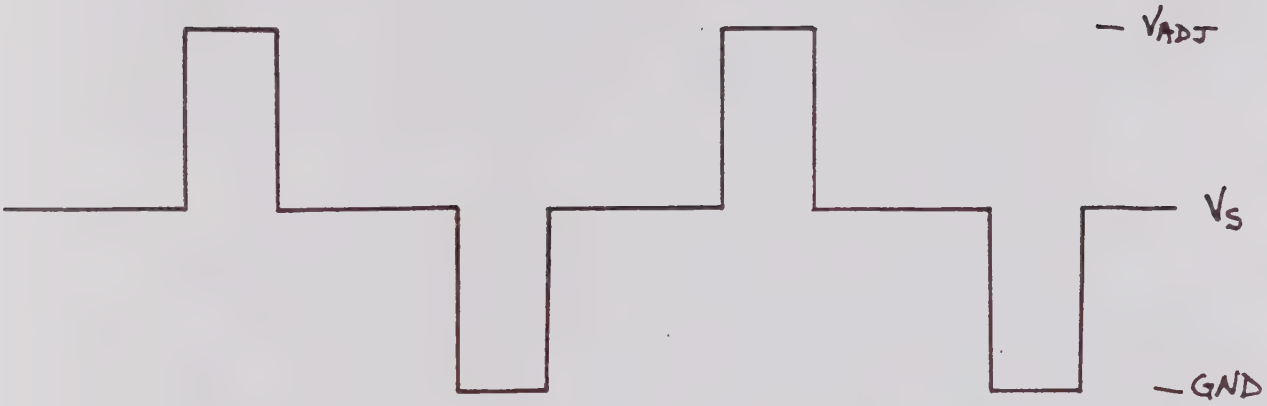
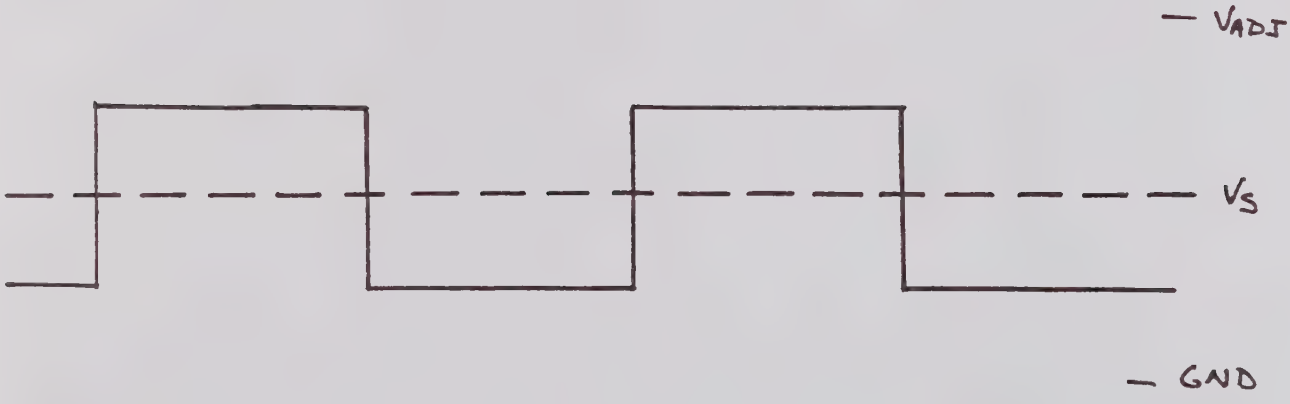


ROW INPUT



COLUMN INPUT

Figure 4-3. LCD Input Waveforms

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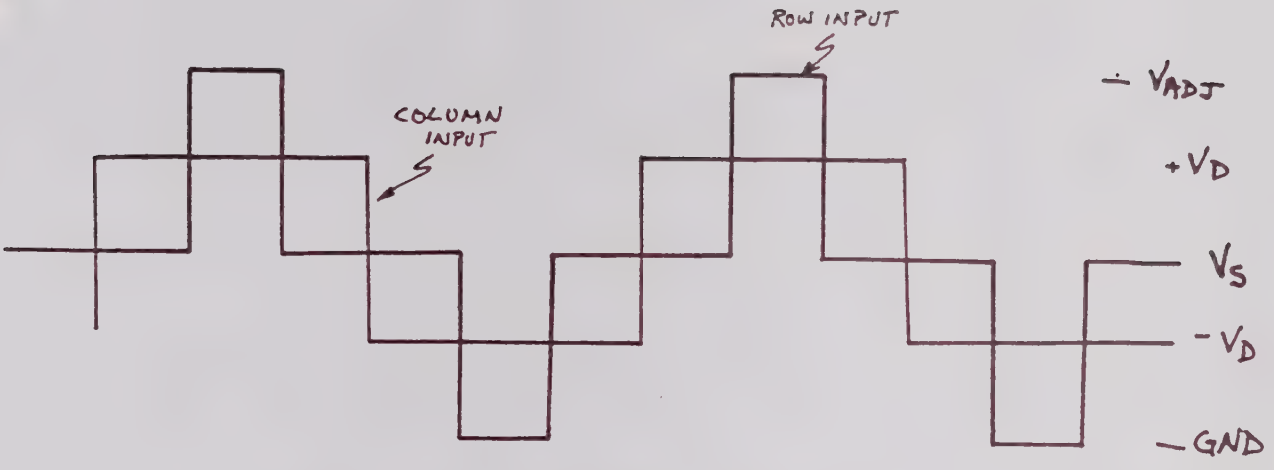
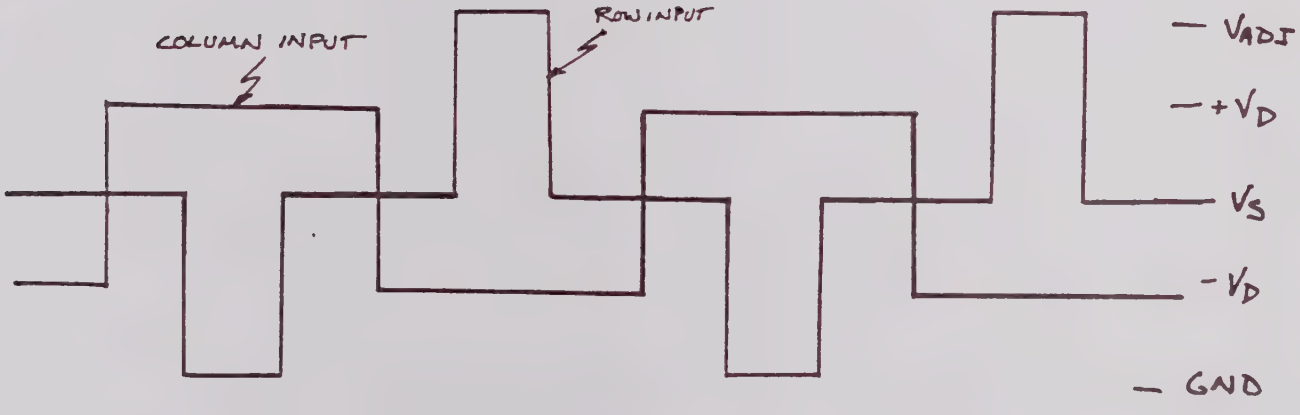


LCD SEGMENT IS OFF



LCD SEGMENT IS ON

Figure 4-4. Segment Input Conditions for On and Off Segments

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4.4 MAIN PROCESSOR BOARD A2

The Main Processor board provides all of the operating functions of the System. In addition, it maintains the charging current for the battery pack and converts the battery power into the supply voltages necessary to operate the unit. The Main Processor also collects data from the Analog board or Keyboard/Display.

4.4.1 Block Diagram Description

The Main Processor board is composed of two major functional sections: a power section and a processor control section. The first consists of power supplies and battery charger; the second contains a microprocessor and its control logic.

Figure 4-5 is a simplified block diagram of the power section. The battery charger receives the AC output from the Transformer board via connector J6 and converts it to a DC current that charges the battery. The battery charger also provides a "charger sense" logic line to the microprocessor via transistor switch Q15. This logic signal is used to indicate a loss of the charging current; i.e., loss of AC power to the unit.

DC power from the battery pack is applied to the Main Processor via J6. The voltage is fed through a fuse to switch S1. When the multi-pole switch is turned on, it activates several functions. Battery power is applied to a 5V regulator as well. In addition, a "set-up sense" signal notifies the processor that the switch has been turned on.

Once power is applied to the regulator, $+V_B$ turns on the processor. The processor transmits a digital signal to the power control which, in turn, enables the analog +5V and turns on the switching power supply. The switching power supply provides the unit with 15V and $\pm$12V for the Analog board. When the unit goes into the standby mode, the processor control input shuts off the analog +5V and disables the switching power supply to conserve power.

The step-up switching power supply provides the unit with 15V for the printer and $\pm$12V for the Keyboard/Display and Analog boards.

Figure 4-6 shows the processor control section of the Main Processor in block diagram form. The CPU controls and maintains this section. Master reset switch S2 is used as a master reset for the entire system. A real time clock furnishes an oscillator input to the CPU which enables the CPU to maintain the unit's real time. All interval timing, the time of day, and other time requirements are maintained with the oscillator output.

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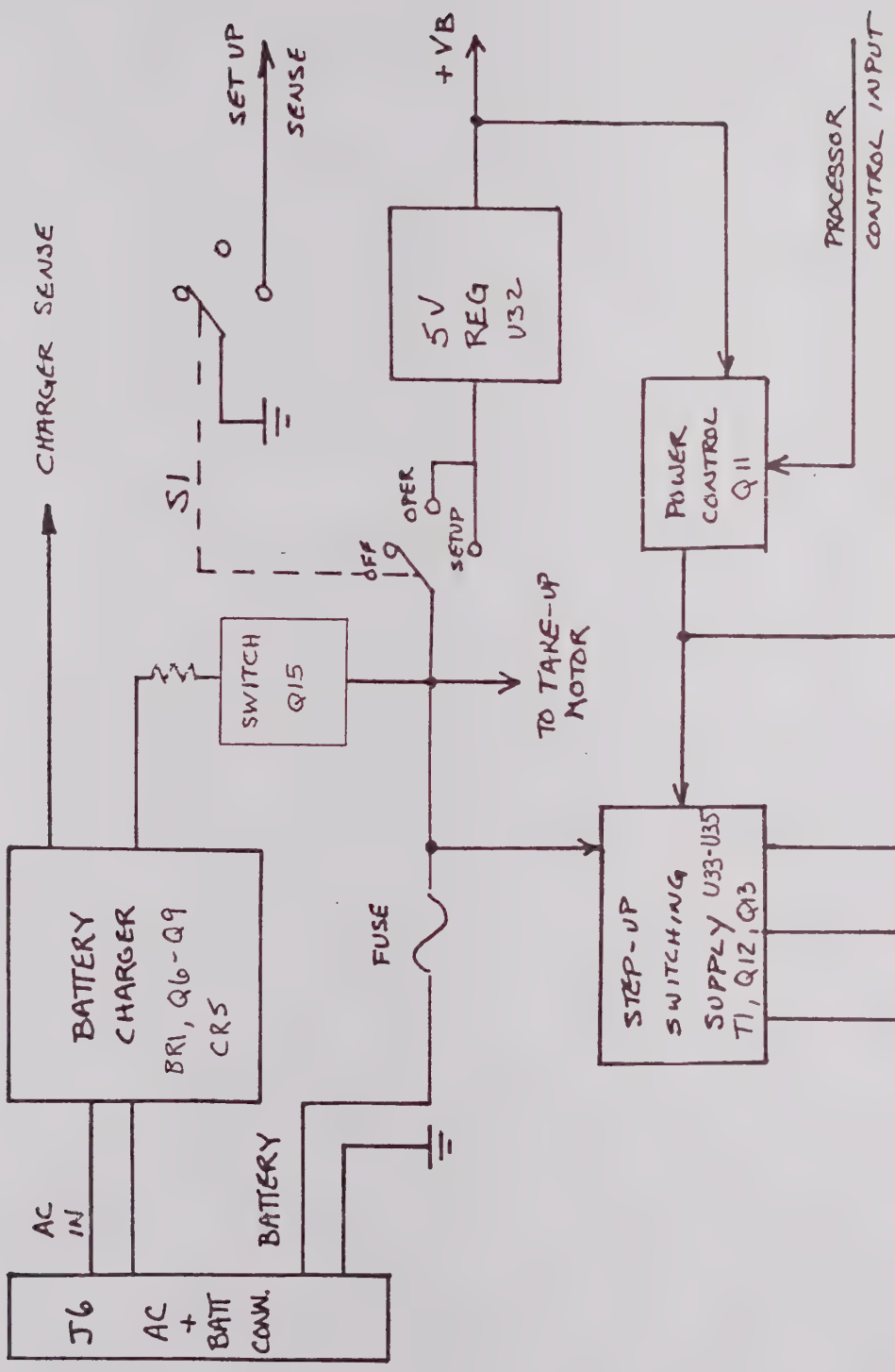

Figure 4-5. Main Processor Power Section, Block Diagram

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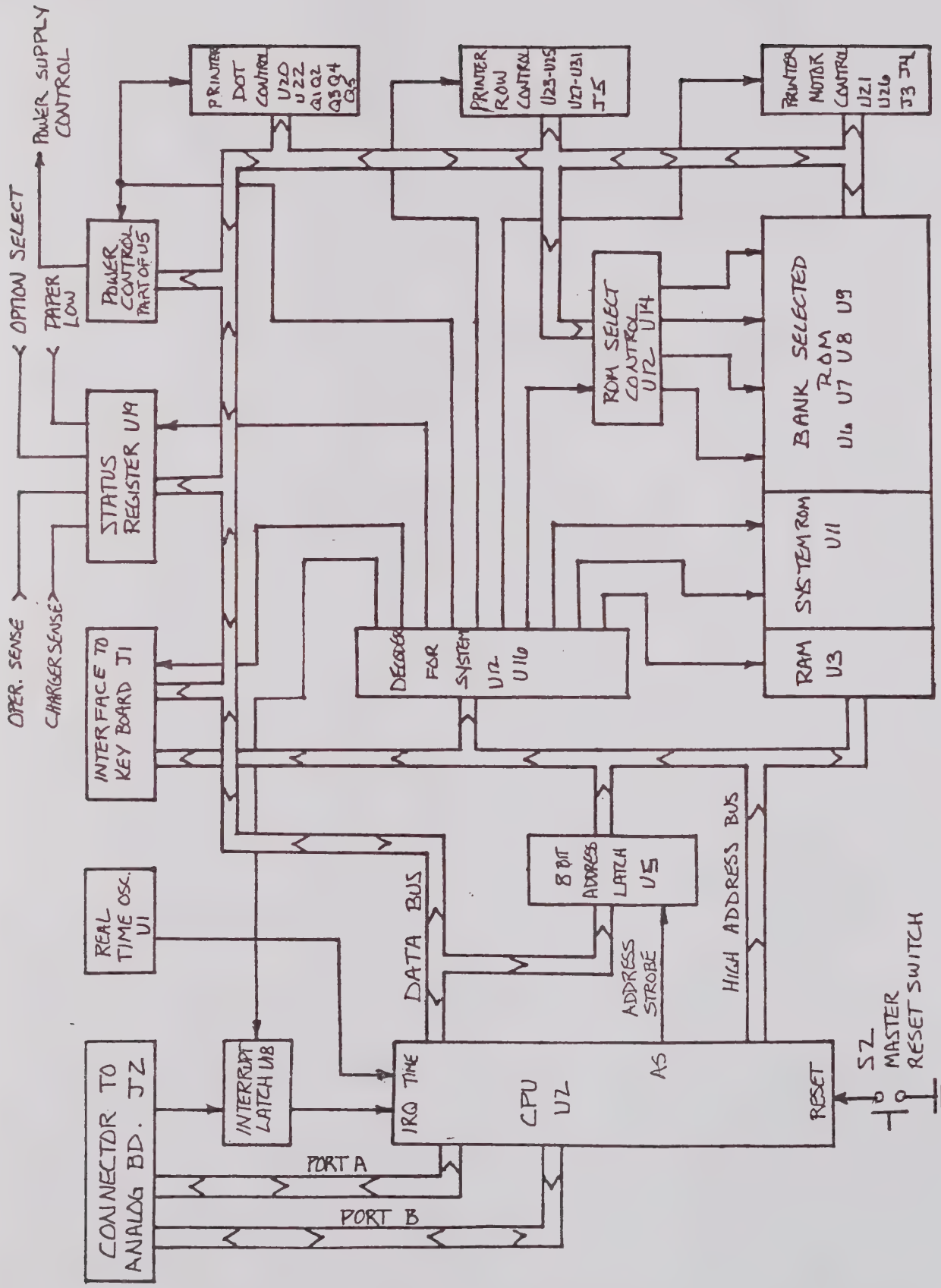

Figure 4-6. Main Processor, Processor Control Section, Block Diagram

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The CPU also has two 8-bit parallel ports (designated A and B) which are connected to the CPU on the Analog board via connector J2. Using these lines and the interrupt line, data and information are passed between the Main Processor and Analog boards.

The data and address lines are used for the remainder of the system. The lower eight bits of the address bus on the Main Processor board are multiplexed with the data bus. The address strobe from the CPU provides the clock needed to latch the lower address lines. Once the address bits are obtained, they are routed to the processor's memory and a decoder. The CPU has access to the following portions of the microprocessor system:

1) Print dot and power on control,
2) Printer row control,
3) Printer take-up motor,
4) Keyboard/Display interface,
5) Status port for the board,
6) RAM,
7) ROM Selector/Decoder, and
8) Interrupt Reset.

4.4.2 Power Section, Detailed Description (See figure 7-2.)

4.4.2.1 Battery Charger Circuit

The stepdown transformer in the Transformer board provides the 8-volt AC power to the battery charger via 4-pin connector J6. The AC voltage is rectified and filtered to DC power by diode bridge BR1 and capacitors C27 and C28. Upon initial turn-on, R15 and C29 form a path for current to flow so that Q9 can be properly biased and activated. At the same time, Q7 is also forward biased, allowing the voltage to drop and current to be drawn from the base of Q6. This forward biases Q6, enabling charging current to flow from its collector to R14 and CR5, and out to the battery pack through connector J6. As the voltage at the anode of CR5 rises or falls (as a function of the battery pack charge condition), the current through R17 and potentiometer R18 into the base of Q9 also rises or falls. The changes in this base current cause the corresponding changes in the collector current of Q9; potentiometer R18 controls the degree of change. As a result, the base current of Q7 changes in the opposite direction, causing the collector current of Q7 to follow suit. Thus, the base current of Q6 is increased or decreased accordingly. The changes in the base current of Q6 result in the same changes in charging current. Therefore, this circuit provides less charging current as the battery becomes fully charged and more current whenever the battery is slightly depleted.

Transistor Q8, in conjunction with R14, provides current limiting to the battery charger. As current increases, the voltage drop across R14 increases. When it reaches a predetermined value, Q8 is forward biased, turning it on. Once Q8 is turned on, it clamps the base to emitter voltage of Q7. This shuts Q7 off, limiting the amount of current drawn from the base of Q6. With less current drawn, the available charging current also drops and is limited.

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Transistor switch Q15 and resistors R20, R44, and R45 provide the charger sense signal V_{SE} to the microprocessor. As long as the charger has a power input, a DC voltage appears at the base of Q15, forward biasing it. With Q15 on, the collector voltage drops, providing a low logic level on the V_{SE} line. This logic level is perceived as a true state by the microprocessor. If the AC input is removed, Q15 is turned off and a high logic level on the V_{SE} line signals the unit that a power failure has occurred.

4.4.2.2 5 Volt Processor Supply

After keyswitch S1 is closed (set to the OPER position), it applies power to voltage regulator U32. The fixed voltage across Zener diode CR7 is fed to reference input pin 3 of U32. The sampled DC voltage from potentiometer R28 is fed to the second regulator input at pin 2. As the voltage difference between pins 2 and 3 of U32 varies, the sink current into pin 8 of U32 changes. This varies the base current being drawn from series regulator Q10, changing the voltage drop from its emitter to collector and thus varying output voltage V_B. V_B is the supply voltage for the processor and any other circuits required to be maintained in the standby mode.

4.4.2.3 Analog 5 Volt Supply

Regulated voltage V_B is also applied to the emitter of transistor Q11. This transistor functions as a switch for the other supplies and is turned on when signal P_{ON} goes low. Once on, the voltage that appears at the collector of Q11 (designated +5V analog) runs the analog 5V supply and any other circuits that are required to be turned on with the P_{ON} signal.

4.4.2.4 Switching Power Supply and ±12 Volt Regulators

After the microprocessor turns on the analog 5V supply, the switching power supply is enabled. Capacitors C40 and C49 at switching regulator U33 are required for adjustment, functioning as the timing capacitors for the switching pulses. Pin 10 of U33 sinks current every time a pulse occurs. This current turns on transistor Q13, enabling FET Q12. Q12 then draws current from the battery pack through pins 1 and 2 of inductor T1. When Q12 shuts off, the lagging or stored current through the inductor runs into diode CR9. Diode CR9 and capacitors C36 and C37 rectify and filter the switching waveform to a DC voltage. Resistors R36 and R37, and potentiometer R35 control the voltage level of V_{PR} by feeding a voltage back to pin 1 of switching regulator U33 to adjust the voltage output. R38, R39, CR10 and Q14 ensure that 12 volt regulator U35 is shut off whenever the switching supply is disabled by a high level on the P_{ON} line.

The second winding (pins 3 and 4) of inductor T1 is used to invert the switching power supply pulses. Once inverted, CR8 and C35 rectify and filter the pulses into a negative DC voltage required to drive -12 volt regulator U34.

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4.4.3 Processor Control Section, Detailed Description (See fig. 7-2)

4.4.3.1 Microprocessor System

The 6805 microprocessor (U2) uses a multiplexed data/address bus. Address bits A0-A7 are formed from the data bus by clocking the bits through octal latch U5 with the falling edge of the address strobe that appears at pin 6 of U2. The other ICs connected to the data bus are gated so that no data is transferred during the address setup. Once the address is obtained, different sections of the system may be accessed. Eight-bit parallel ports A and B of microprocessor U2 are used for data transmission to and from the Analog board via connector J2.

4.4.3.2 Central Memory

When the address is valid, microprocessor U2 obtains program information from PROM U11 by addressing decoder U12. Data to be stored, such as that programmed by the user, is written into RAM U3. PROMs U6 through U9 are addressed by writing data to the latches of U14 and decoding it with the second half of U12. When running, the processor enables only one of the PROMS (U6-U9 and U11) at one time.

4.4.3.3 Keyboard/Display Interface

Connection to the Keyboard/Display is made through connector J1 on the Main Processor. Once addressed by the CPU via decoder U12, the CPU can read and write data to and from the Keyboard/Display. (See para. 4.3 for more details.)

4.4.3.4 Interrupt Control

When the Analog board desires to cmmunicate with the Main Processor board, it generates an interrupt by strobing the line from its board through J2-23 of the Processor board into the clock input (pin 3) of latch U18. The output of this latch is connected directly to the interrupt input (pin 2) of microprocessor U2. When U2 desires to clear the interrupt, it addresses U16. The Y7 output (pin 7) of U16 is inverted by U17-10, resetting the latch and thereby clearing the interrupt.

Another input to U2 that generates an interrupt is the real time clock input at pin 37. The oscillator output from pin 4 of U1 is jumpered by a connection in W1 to the TIM IN input, pin 37, of U2. Directed by the microprocessor, the internal interrupt is used to maintain the real time clock of the system. The total count of time is under software control.

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4.4.3.5 Status Register and Control Lines

Microprocessor U2 turns on the power supplies by clocking latch U20 from the pin 14 output of U16. The data is then clocked through position 6D (pin 14) to position 6Q (pin 15) of decoder U20. This latched data bit produces signal P_{ON} when it passes through buffer U22.

Tristate hex buffer U19 is used as the status register. Microprocessor U2 uses this buffer to determine the status of the paper low switch, the charger sense line V_{SE}, the position of keyswitch S1 and the status of the option select connections in J7. The microprocessor recognizes these different functions as logic levels in the data read from this register.

4.4.3.6 Printer Controls

The printer stepper and take-up motors are controlled by the data transmitted from the processor to latch U21. The data that is latched is used to drive the inputs of driver U26. U26 contains an array of transistor used to sink the necessary currents to drive the two printer motors. Connections for the stepper motor are made via 6-pin connector J3. The take-up motor is connected to the Main Processor board through 4-pin connector J4.

Each character pf the thermal printer consists of 5x7 matrix of dots. The processor causes the printer to print the top row of the matrix for 20 characters across. The sequence for a row starts with processor U2 sending data to latch U20. This data turns on Q1, using transistor U22 for a current sink. Q1 allows the current to flow, causing the thermal printhead to print the first dot for each character. Processor U2 then sends data to latches U27 through U31. Once clocked in, this data determines which of the 20 characters are to have the first dot printed. The processor then proceeds to print the second dot by turning on Q2 and sending new data to the latches. This continues for the third dot using Q3, the fourth dot using Q4 and the fifth using Q5. Each time new data is latched into U27 through U31 to determine which characters are to have their dots printed. After the 100 dots (20 characters, 5 dots each) of the characters have been processed, the processor causes the stepper and take-up motors to move by sending data to latch U21. Once latched, the data causes current to flow through the motors. The motors now move the printer to the next row of dots and the next row is printed. The above sequence is repeated until all seven rows of characters have been processed.

4.5 ANALOG BOARD A3

The Analog board is responsible for the measurement and conversion of analog or pulse data into a form suitable for processing by the Main Processor board. The gain of the analog input channels is controlled by the Analog board which also multiplies the voltage and current inputs to

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measure watts, and samples and converts the measured signals into digital format. The board also handles pulse inputs applied to the unit and controls relay contacts.

4.5.1 Block Diagram Description (See fig. 4-7.)

The Analog board may be divided into three functional sections. The first consists of the microprocessor U44 and its programming. The next section is the analog measuring function which consists of buffers, gain stages and an analog to digital converter. The remaining circuits monitor the pulse inputs and control the analog section.

The microprocessor system consists of U44, octal latch U39, PROM U37 and and decoder U40. Microprocessor U44 uses octal latch U39 to address PROM U37. Once addressed, PROM U37 provides the program to operate the board. This information determines which data is to be transmitted to or from the Analog and Main Processor boards via connector J5 as well as the timing of such data transfer. The program also determines when the analog measuring function is to sample, change gains, multiply current and voltage to obtain watts, convert analog data to digital form, or address the pulse input hardware.

In the analog measuring circuit, the inputs to be monitored are connected to the board via J1 through J4. Connector J1 accommodates the voltage phase inputs; J2 through J4 service the current input channels. Input signals are attenuated and buffered by operational amplifiers U1-U4, then applied as voltages to analog switches U5 and U6. The selected signals are then fed to autorange amplifiers (U7/U9 for voltage channels and U13/U12 for current channels). With feedback from microprocessor U44, the autorange amplifiers are maintained at an optimal level for the A/D converter.

The digital states of switches SWA-SWC and the condition of jumper terminals W1-W5 are monitored by the microprocessor via status registers U41-U43. Sync pulses, applied via barrier block TB2, optocoupler U35, and flip-flop U34, are monitored by status register U42. Initiator pulses are applied through TB2, optocouplers U32 and U33, and flip-flop U34 to buffers and counters U36, U41 and U42 where they are also monitored by the microprocessor.

Latches U24 through U29 receive data from the microprocessor which determine when to sample, which gains to be set, when to multiply and what to convert in the analog measuring section.

4.5.2 Analog Board, Detailed Description (See fig. 7-3.)

Microprocessor U44, a 6805, is the same type used on the Main Processor board. A valid address is obtained by clocking the data for the address into octal latch U39 with the address strobe (AS) supplied by pin 6 of

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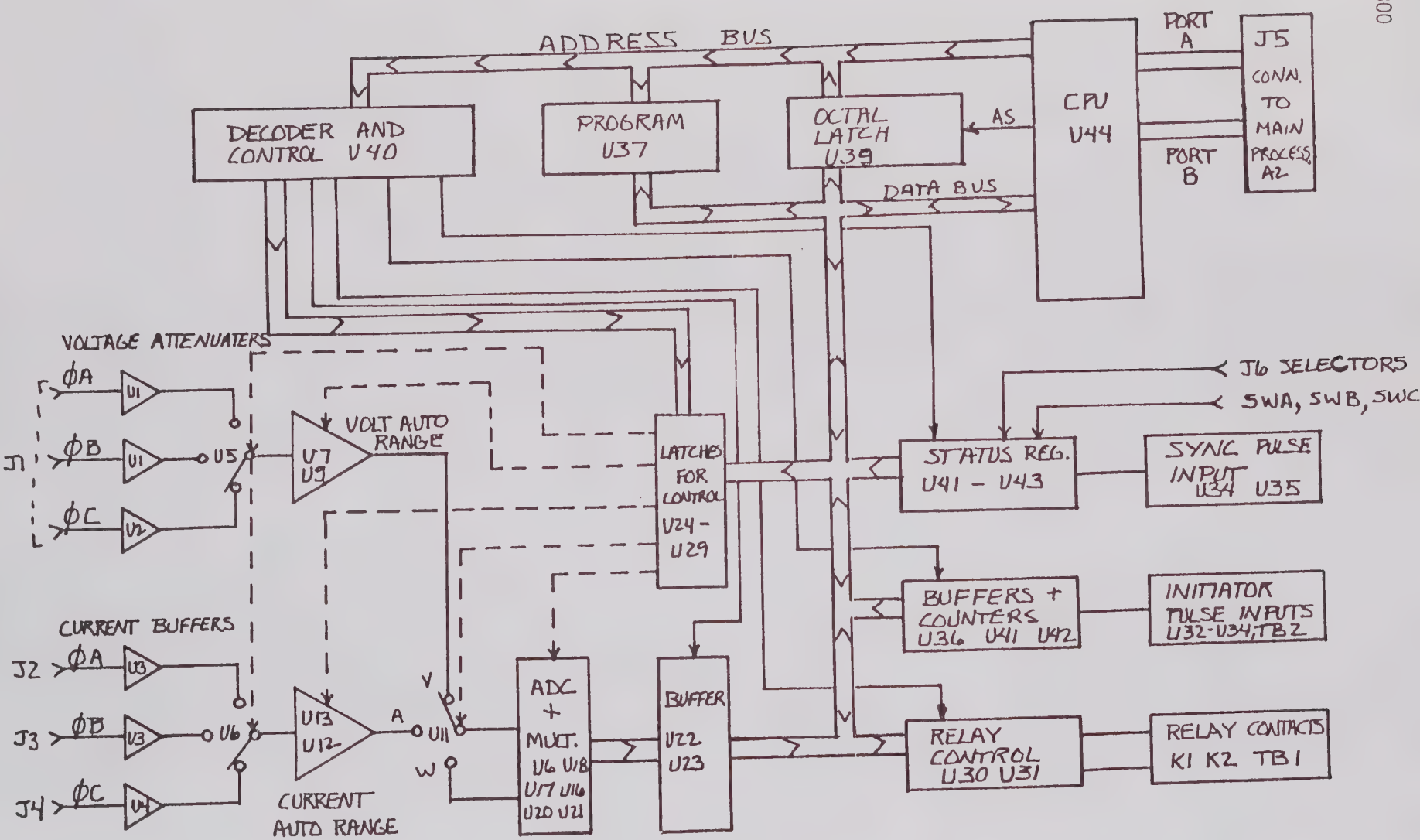

Figure 4-7. Analog Board, Block Diagram

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U44. After obtaining the address, U44 can either use the programmed memory (U37) or decoder U40. The decoder enables U44 to address and control the rest of the board.

4.5.2.1 Voltage Channels and Autoranging

The three voltage phases to be measured are connected to the Analog board via pins 1, 3, 5, and 2 (phases A, B, C, and neutral or return line, respectively). Each voltage phase is applied to a corresponding differential amplifier (U1 and U2). After attenuating the inputs, the amplifier outputs are made available to voltage autoranging stages U7 via quad analog switch U5.

Analog switches U5 are controlled by latch U24. The latch receives 4-bit data from microprocessor U44 and is clocked by the pin 13 output of decoder U40. The decoder outputs are selected by address data from U44. Once activated, the selected analog switch connects the desired voltage channel to voltage autoranging stages U7.

The gain of voltage autoranging amplifier U7 is controlled by analog switches U9 (pins 1,2,3 and 6,7,8) which connect resistors R47, R48 and R83 into the gain loop of the operational amplifier. These switches are turned on and off by latch U27. The latch receives data from U44 and is clocked by the pin 12 output of decoder U40. The decoder outputs are selected by the address data from U44. In this fashion, the microprocessor sets the gain to be used for the voltage channels.

4.5.2.2 Current Channels and Autoranging

The system requirement specifies that the inputs for the current channels must be a voltage level proportional to half the current level of the phase being measured; i.e., 0.5V per ampere. The three proportional inputs are connected to the Analog board via connectors J2, J3, and J4. Each input is fed to an associated differential amplifier (U3 and U4) where pin 3 of connectors J2, J3, and J4 is the input side and pin 4 is the return. These amplifiers serve as buffers for the current input section. Microprocessor U44 selects a particualr channel for processing by sending data to latch U25 and clocking the latch with a signal from pin 13 of decoder U40. The data applied to the latch determines which analog switch is turned on, selecting a particular channel for application to autoranging amplifier U13.

The gain of current autoranging amplifier U13 is controlled by quad analog switch U12. Data from U44 is clocked into latch U26 by the output signal from pin 12 of decoder U40, enabling one of the U12 switches. Once activated, the switch connects resistor R51 or R52/R85 or R53 into the gain loop of U13. In this manner, the microprocessor can change the gain of the selected current channel, switching resistors in and out of the gain circuit.

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4.5.2.3 Sampling and Multiplexing

After passing through the associated gain-controlled autoranging amplifiers, the signals are applied to sample and hold stages; U8 for the voltage inputs and U14 for current. These IC's hold the voltage level applied to their inputs when a signal from pin 10 of latch U29 goes low. Once held, the level can be routed to the A/D converter circuits via multiplexer U11. When clocked by the output from pin 11 of decoder U40, data transmitted to latches U28 and U29 determines whether current, voltage or wattage signals are to be connected to comparator U17 at the input of the analog to digital converter circuit. After conversion, the digital data for a given channel is squared and added to previously squared samples. After sampling over several cycles, microprocessor U44 can calculate the true RMS value of voltage or current.

4.5.2.4 Analog to Digital Conversion and Multiplication

Analog to digital conversion is initiated by microprocessor U44 which passes data to pin 2 of latch U29. The conversion then starts with bit Q11 of approximation register U21 set. This bit passes to D/A converter U20 whose current output at pin 1 controls buffer U16. The output of U16 is compared, at comparator U17, with the sample furnished by multiplexer U11. If the output bit is to be set, the error signal from U17 will be true, setting the bit. Bit Q10 of approximation register U21 is then set and another comparison is made. This process continues until the conversion is complete. At this time, register U21 sets pin 3 low, signalling U44 that the data in buffers U22 and U23 is valid. This data is used by U44 to perform the autoranging measurements.

Wattage measurements (multiplication of current and voltage) are accomplished by D/A converter U20. While a current channel is selected by analog switch U11, the microprocessor switches the voltage channel (at pin 15 of U11) into the reference input (pin 15) of D/A converter U20 via amplifier U18. The output of the D/A converter is then sampled and held by U10. The held voltage is fed to multiplexer U11 and out to comparator U17 for conversion.

4.5.2.5 Control Signals and Digital Inputs

The remaining sections of the Analog board enable the microprocessor to determine the state of control lines, sense the user's pulse input and control the alarm contacts.

To determine the digital state of switches SWA, SWB, and SWC, as well as the status of jumper terminals W1 through W5, microprocessor U44 addresses decoder U40, causing pin 7 to enable tristate buffers U41, U42 and U43. The buffers then pass an 8-bit word to U44. These bits provide the information required by U44 to run the Analog board program.

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The initiator and external sync pulses are connected to the Analog board through barrier block TB2. These pulses are normalized by optocouplers U32, U33 and U35, the outputs of which are applied to flip-flops U34. The flip-flop for the initiator pulses drives counter U36 whose output can be accessed by the microprocessor, using buffers U41 and U42, in conjunction with decoder U40 (output pin 9). The flip-flop for external sync input is fed to buffer U42 and is read by the microprocessor along with switches SWA-SWC and jumper terminals W1 through W5.

4.6 TRANSFORMER BOARD A4 (SEE FIG. 7-4.)

The Transformer board steps down and isolates the power line voltage to the level required by the battery charger on the Main Processor board. The AC input power leads are connected to the board at E2 and E3 via a line cord. Switch S1 configures the primary windings of transformers T1 and T2 to accept either 115 volts (windings in parallel) or 230 volts (windings in series). The stepped down voltage at the secondaries of T1 and T2 are connected to E4 and E5. A harness is connected from these output points to a 4-pin connector (P1) which mates with connector J6 on the Main Processor board.

4.7 PRINTER ASSEMBLY A5

4.7.1 Block Diagram Description (See fig. 4-8.)

Digital data from the Main Processor board passes through the connector A5A1P1 on a flexible cable to the printhead. After a row of dots is printed, the Main Processor board sends data through connectors P1 and P2. This data runs the stepper and take-up motors. The printer paper is then in position for the next row of dots.

4.7.2 Detailed Description

Figure 7-5 shows the mechanical assembly of the printer. All of the data and control lines for the printer assembly are derived from the Main Processor board.

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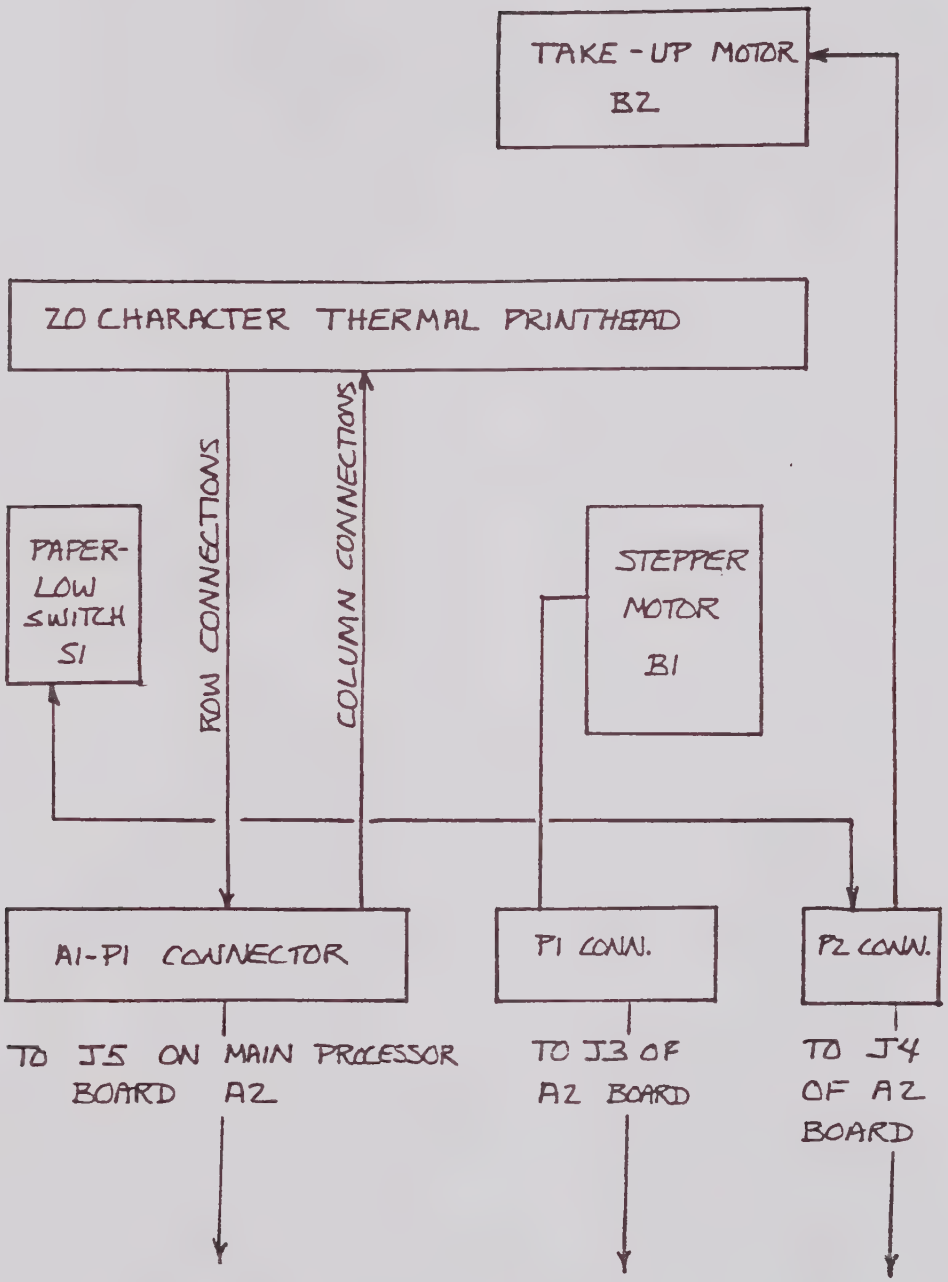

Figure 4-8. Printer Assembly, Block Diagram

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SECTION V

MAINTENANCE AND ADJUSTMENT

5.1 SCOPE

This section contains test and adjustment procedures and other data that will help ensure continuity of of service of the 808 Electric Power Demand Analyzer. Items of special equipment designed for field service testing of the units are identified and step-by-step instructions are provided for their use.

WARNING

THESE SERVICING INSTRUCTIONS ARE INTENDED FOR QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATOR'S MANUAL UNLESS YOU ARE QUALIFIED TO DO SO.

READ INSTRUCTIONS CAREFULLY

Because of the potential shock or fire hazards, do not perform any task for which you are not qualified.

5.2 TEST EQUIPMENT REQUIRED

Table 5-1 lists test equipment recommended for adjustment and maintenance of the unit. Substitution of equivalent equipment may be made.

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Table 5-1. Test Equipment Required

Item	Characteristics	Model
Voltmeter	DC General Purpose Accuracy: ±1%	Fluke 8600A
Oscilloscope	Bandwidth: 0 Hz to 10 MHz	Phillips PM3233
Timer/Counter	10 Hz - 80 MHz Accuracy: ± 1 Count ± Time Base Error	Phillips PM6612
Wattmeter	Volt and Amp Reading Accuracy: ±0.05%	Dranetz 3100
AC Source	Sinewave Voltage Outputs 0 to 10V rms Stability: ±0.1V rms 0 to 600V rms Frequency: 45.0 to 65.0 Hz Stability ±0.1 Hz	Khrone-Hite K1000A Audio Oscillator with Bogen MT125B. Audio Amplifier and Xfrmrs; step-up ACME TA1-81000, step-down Signal 241-3-10
Connector Kit	Mates with Analog Board Input Connectors	Dranetz P/N 110656
DC Supply	0 to 10V Stability: ±0.01V	Hewlett-Packard 6284A with 100,000 uf cap on output

5.3 PRELIMINARY SETUP (UNIT DISASSEMBLY)

Complete disasssembly is required to make the required boards accessible for adjustment. Turn off the unit and unplug it from the power line before attempting to disassemble it.

1) Remove the four black screws, two on each side, and the two small rubber feet from the top of the unit case. Remove case top.

2) Remove the two white retaining blocks, noting their direction. Loosen the bracing bar so that the sides of the case open slightly.

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3) Remove the key shaft by compressing the two retension springs around it. Remove the ribbon cables from the large boards. Remove the nylon screw from the rear panel (upper left corner).

4) Remove the front panel and the Main Processor Board together. Note that these two boards are still connected on the bottom; be careful not to bend or break the flex cable which connects the Main Processor board to the printer. As the boards are being pulled out, disconnect the battery connector from connector J6 of the Main Processor Board. Place the front panel and Main Processor Board on the bench.

5) Remove the communication board if the unit has Communication Option 105 or 106, and place this board on the bench. Refer to TM-111310-G1/G3 (enclosed at the rear of this manual) for specific details on either option.

6) Unscrew small rubber feet near the bottom of the rear panel. Remove the rear panel and analog board together. After they are out of the case, place the analog board on the bench.

7) With the rear panel still connected to the battery pack, remove the battery pack by taking out four screws from the bottom of the case. Place the battery pack on the bench.

8) Reassemble the unit outside of its case on the bench as shown in figure 5-1. Reattach all connectors to the boards. At this time, do not reattach the communication board if the unit contains this option.

8) To reassemble the unit after readjustment, refer to figure 7-6 in this manual. If the unit contains a communication board, refer to figure 7-1 in TM 111310-G1/G3.

5.4 ADJUSTMENT

5.4.1 Main Processor Board (See figures 7-2 and 7-9.)

In general, this board will not require adjustment. However, the following adjustment procedures are presented for reference.

5.4.1.1 Battery Charger Current Level Adjustment

1) Be sure that the front panel keyswitch is still in the OFF position. Disconnect the battery pack and connect the regulated DC supply in its place. Plug in the AC line cord to apply power to the battery charging circuit. Always make note of the battery polarity.

2) Set the DC supply to 6.8V and adjust potentiometer R18 on the Main Processor board such that the current through R14 is 15 mA $\pm$ 5 mA.

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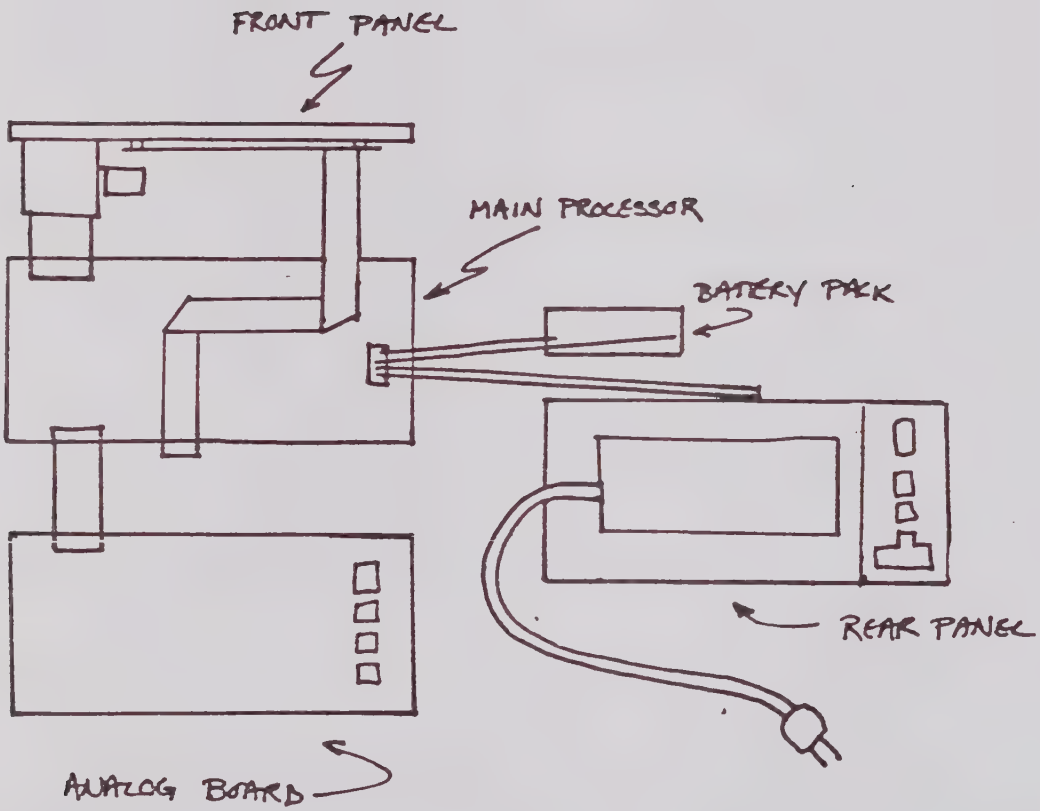

Figure 5-1. Top View of Reassembled Unit on Work Bench

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3) Set the DC supply to 6.4V and verify that the current through R14 is 420 mA or higher. Disconnect the AC power and reconnect the battery pack.

5.4.1.2 Power Supplies Voltage Adjustment

1) Using the keyshaft as a lever arm, turn the keyswitch to the SETUP position (two positions clockwise on switch S1).

2) With the unit on and functioning, adjust potentiometer R28 until the voltage across C15 (near U8) is 5.30V ±0.05V.

3) Adjust R35 until the voltage across C25 is 15.0V ±0.1V.

5.4.1.3 Real Time Oscillator Adjustment

1) Connect the frequency counter to pin 4 of U1 and adjust capacitor C1 for a period of 1953.125 ±0.001 usec.

5.4.2 Keyboard/Display LCD Contrast Adjustment
(See figures 7-1 and 7-8.

With the unit still on, adjust R13 to maximize the contrast of the LCD display; i.e., dark alpha-numerics with light background.

5.4.3 Analog Board (See figures 7-3 and 7-10.)

5.4.3.1 Analog to Digital Converter's Reference Adjustments

1) With power still applied to the unit, short together the two pins at position W4 of J6. (J6 is near RN1.)

2) Depress the red switch, S2, on the Main Processor board.

3) Set the A/D reference by adjusting potentiometer R66 such that the voltage from pin 6 of U18 to ground is 10.000V ± 0.008V.

4) Remove the short circuit from position W4 of J6. Now depress red switch S2 on the Main Processor board.

5.4.3.2 Common Mode Adjustment for Voltage and Current Channels

1) Using the Voltage Cable, P/N 110686, or the voltage connector from the Connector Kit P/N 110656, short the phase A, B, and C inputs of J1 to neutral (pins 1, 3, and 5, respectively, to pin 2). Now apply 115V rms from the AC source to the shorted inputs and the ground conductor, pin 6 of J1.

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2) Adjust the AC common mode of each voltage channel by minimizing the outputs, using potentiometers R5, R12, and R19. Adjust channel A with R5, minimizing the output at pin 7 of U1. Adjust channel B with R12, monitoring the output at pin 1 of U1. For channel C, adjust R19, checking the output at pin 1 of U2. In each case, the output should be reduced to 115 mV peak or less. When the adjustments have been made, disconnect the 115V rms input and remove the short circuits from the voltage channel inputs.

3) Using the current connectors from the Connector Kit, short together pins 3 of J2, J3, and J4. Do the same with pins 4 of J2, J3, and J4. Now short these two connections together and apply 10V rms from this short to ground, pins 6 of J2, J3, and J4.

4) Adjust each current channel's AC common mode by minimizing the outputs with the use of potentiometers R27, R34, and R41. Adjust channel A with R27, minimizing the output at pin 7 of U3. Adjust channel B with R34, monitoring the output at pin 1 of U3. For channel C, adjust R41, checking the output at pin 1 of U4. In each case, the output should be reduced to 10 mV peak or less. When the adjustments have been completed, remove the 10V rms input and remove the short circuits from the current channel inputs.

5.4.3.3 DC Offset Adjustment for Voltage, Current and Wattage

1) To adjust the DC offset to the Analog board, short the two pins of position W5 of J6 together. Depress the red switch S2 on the Main Processor board.

2) Leave the prompt mode and set the status printout for all current channels. Refer to the Operator's Manual for the proper sequence of commands and instructions on setting up the status printout.

3) Adjust potentiometer R60 so that the status printout of the current channels is as close to 0.0000A (for all three channels) as possible. A typical reading for the individual channels is 0.0100A. Check the adjustment by displaying printouts of total average volts. The total should read 0.0000V. If it does not, readjust R60 slightly until it does.

4) Print out total watts. Adjust R55 until the watts printout drops to a minimum.

5) Remove the short from position W5 on J6 and depress red switch S2 on the Main Processor board.

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5.4.3.4 Voltage Channels Gain Adjustment

CAUTION: HIGH VOLTAGE - SHOCK HAZARD.

1) Apply 600.0V rms ± 0.3V rms between the voltage channel inputs (pins 1, 3, and 5 of J1) and neutral (pin 2 of J1). Verify that the ground pin (pin 6) of J1 is tied to the AC source ground.

2) Print out the channel A voltage. Adjust potentiometer R6 so that the channel A voltage is 600.0V ± 3.0V. Verify that the setting agrees with the wattmeter's reading.

3) Repeat step 2 for voltage channel B, using R13 to adjust the channel B reading.

4) Repeat step 2 for voltage channel C, using R20 to adjust the channel C reading.

5) After all voltage channels have been adjusted, decrease the output of the AC source to 300.0V rms ± 0.2V rms. Verify that each of the voltage channels reads 300.0V ± 1.8V rms. If necessary, repeat steps 1 through 4. Remove the 600V input.

5.4.3.5 Current Channel Gain Adjustments

1) Apply 5.000V rms ± 0.003V rms between pins 3 and 4 of J2, J3 and J4. Connect pin 6 of J2, J3 and J4 to the ground of the AC source. Note that 1 ampere on a current channel is equal to 0.5V on the inputs.

2) Print out channel A current and adjust potentiometer R28 until the channel A current reads 10.00A ± 0.05A. Verify that the reading agrees with the wattmeter's reading.

3) Repeat step 2 for channel B, adjusting R35 for the specified value.

4) Repeat step 2 for channel C, adjusting R42 for the specified value.

5) After adjusting the current channels, reduce the AC input to 2.500V rms ±0.013V rms. Verify that each of the current channels reads 5.000A ± 0.025A. If necessary, repeat steps 1 through 4. Reapply the 5.000V rms ±0.003V rms to the current channels.

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5.4.3.6 Wattage Gain Adjustment

1) Apply 600.0V rms ± 0.3V rms to all three voltage channels and 5.000V rms ± 0.025V rms to the current channels. Verify that both voltage and current inputs are in phase with one another; i.e., PF = 0.99 or 0.0 degrees between them. Set the unit's status to print out all wattage channels.

2) The wattage reading generated by voltage and current inputs should now read 6.000 KW ± 6W on the 3-channel status printout.

3) The wattage gain for all three channels is adjusted by R62. Adjust R62 until all three channels on the status printout read 6.000 KW ± 60W. Verify the printouts with the wattmeter.

4) Shut off the unit, disconnect AC power and inputs and reassemble the unit.

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SECTION VI

REPLACEABLE PARTS LIST

This Replaceable Parts List identifies all maintenance parts in the Series 808 Electric Power Demand Analyzer. For each part, the reference designation (if applicable) is shown, along with the part number, manufacturer's code number and description. All maintenance parts are shown in the assembly drawings located in Section VII.

The manufacturers' codes in this parts list are identified below:

MAN. CODE	MANUFACTURER
00779	Amp, Inc., Harrisburg, PA 17105
23207	Dranetz Technologies, Inc. 1000 New Durham Road Edison, N.J. 08818
28520	Heyco Inc., Kenilworth, N.J. 07033
51406	Murata-Erie Inc., Marietta, GA 30067
52458	Magnum Corp., Erie, MI 48133
62806	United Carr Supply Division of TRW, Plainfield, N.J. 07063
70903	Belden Manufacturing Co., Chicago, IL 60644
81349	On Mil Spec List. Manufactured to meet military specifications. Available from a variety of suppliers.
83014	Nylatch-Hartwell Corp., Palcentia, CA 92670
	Mabuchi Motor Co., Ltd., New York, N.Y. 10016

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REPLACEABLE PARTS LIST

808 ELECTRIC POWER DEMAND ANALYZER MAINFRAME P/N 110300-G( )

REF DESIG	PART NO.	MAN. CODE	DESCRIPTION
A1	110350	23207	Keyboard/Display
A2	110356-G1	23207	Main Processor
A3	110362-G1* or 110362-G2*	23207	Analog Board
A4	111817-G3	23207	Power Transformer
A5	110345-G1** or 110345-G2***	23207	Printer Assy
	110610	23207	Display Cable
	110611-G1	23207	Analog Cable
	110686	23207	600V Cable Assy
BT1	110844-G1	23207	Battery
	SR-5MN-3	28520	Strain Relief
	17205-BLK	70903	Power Supply Cord (Black)
	103255	23207	Switch Lock
	102714-G2	23207	Paper Roll (4)
	110344-G1** or 110344-G2***	23207	Key Shaft
	104858**	23207	Membrane Switch
	104852***	23207	Membrane Switch
P1	1-480702-0	00779	Socket Housing
	350550-1	00779	Sockets, Crimp (4)
	3-350820-2	00779	Fast Ons

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*Either/or supplied, per order
**Used in G1 version only
***Used in G2 version only

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REPLACEABLE PARTS LIST

KEYBOARD/DISPLAY A1, P/N 110350

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
A1	PKM11-4A0	51406	Audio Alarm
C1-C11	103208-G4	23207	Cap, 0.1 uf, 20%, 50V
C12,C13	104067-G8	23207	Cap, 2.2 uf, 10%, 25V
C14,C15	104020-G1	23207	Cap, 470 pf, 5%, 500V
CR1-CR7	104412-G2	23207	Diode
DS1,DS4	104427-G1	23207	LED (Grn)
DS2,DS6	104427-G2	23207	LED (Yel)
DS3,DS5	104427-G3	23207	LED
J1	102160-8	00779	Rt. Angle Conn., 34 Pin
	102312-2	00779	P/O J1
J2	1-640455-1	00779	Rt. Ang. Header, 11 Pin
R1,R2	RN55C8871F	81349	Res, 8.87K, 1%, 1/10W
R3,R4	RN55C4121F	81349	Res, 4.12K, 1%, 1/10W
R5	RCR07G512J	81349	Res, 5.1K, 5%, 1/4W
R6	RCR07G623J	81349	Res, 62K, 5%, 1/4W
R7,R10	RCR07G102J	81349	Res, 1K, 5%, 1/4W
R8	RCR07G203J	81349	Res, 20K, 5%, 1/4W
R11,R12	RCR07G474J	81349	Res, 470K, 5%, 1/4W
R13	104701-G2	23207	Res, Var, 20K, 10%, 1/2W
R14,R18	RCR07G241J	81349	Res, 240 ohms, 5%, 1/4W
R15,R17	RCR07G361J	81349	Res, 360 ohms, 5%, 1/4W

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REPLACEABLE PARTS LIST

KEYBOARD/DISPLAY A1, P/N 110350 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R16,R19	RCR07G121J	81349	Res, 120 ohms, 5%, 1/4W
RN1,RN2	104798-G3	23207	Res. Network, 51K
RN4	104798-G1	23207	Res. Network, 20K
RN5	104798-G2	23207	Res. Network, 8.2K
U1-U3	104203-G5	23207	IC, Analog MPX
U4-U13	104206-G5	23207	IC, Shift Register
U14,U15	104202-G3	23207	IC, Quad Latch
U16,U17,U26	104225-G8	23207	IC, Lvl Trans
U19	104222-G4	23207	IC, Buffer Driver
U20	104225-G2	23207	IC, Hex Latch
U21	104387-G1	23207	IC, Tri-State Buffer
U22	104201-G1	23207	IC, Dual Flip-flop
U23	104200-G5	23207	IC, Quad NAND Gate
U24	104236-G2	23207	IC, Op Amp, JFET
U25	104388-G1	23207	IC, Decoder
U27	104252-G1	23207	IC, LCD Display

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REPLACEABLE PARTS LIST

MAIN PROCESSOR BOARD A2, P/N 110356-G1

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
BR1	104428-G1	23207	Bridge Rectifier
C1	104109-G5	23207	Cap, Var, 4-18 pf, 250V
C2,C6,C7	104016-G4	23207	Cap, 20 pf, 5%, 500V
C3,C4,C10-C12, C29,C38,C41,C42	103209-G2	23207	Cap, 0.22 uf, 20%, 50V
C5	103209-G3	23207	Cap, 0.47 uf, 20%, 50V
C8,C9,C13-C24, C26,C31,C44,C47	103208-G4	23207	Cap, 0.1 uf, 20%, 50V
C25	104067-G9	23207	Cap, 10 uf, 20%, 25V
C27,C28,C35	104075-G2	23207	Cap, 470 uf, 20%, 25V
C30	104020-G3	23207	Cap, 620 pf, 5%, 300V
C32	104075-G1	23207	Cap, 220 uf, 20%, 25V
C33,C34	104075-G3	23207	Cap, 1000 uf, 20%, 10V
C36,C37	104075-G4	23207	Cap, 1000 uf, 20%, 25V
C39	104023-G5	23207	Cap, 330 pf, 2%, 500V
C40	104018-G5	23207	Cap, 150 pf, 5%, 500V
C43,C45,C46,C48	104067-G8	23207	Cap, 2.2 uf, 10%, 25V
CR1,CR3,CR4	104412-G2	23207	Diode
CR2	104429-G2	23207	Diode, Zener
CR5	104430-G1	23207	Diode, Schottky
CR7	104429-G1	23207	Diode, Zener
CR8	104408-G1	23207	Diode, Fast Recovery
CR9	104431-G1	23207	Diode, Schottky
CR10	104429-G3	23207	Diode, Zener

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REPLACEABLE PARTS LIST

MAIN PROCESSOR BOARD, P/N 110356-G1 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
F1	107545-G1	23207	Fuse, 8A
J1,J2	102160-8	00779	Rt. Angle Conn., 34 Pin
Used @J1,J2	102312-2	00779	Connector Latch
J3	640454-6	00779	Post Header, 6 Pin
J4	640454-4	00779	Post Header, 4 Pin
J5	2-640455-5	00779	Rt. Angle Post Header, 25 Pin
J6	350430-1	00779	Connector, 4 Pin
J7	87543-3	00779	Header, 6 Pin
Q1-Q5	104541	23207	Transistor, Pwr, Darlington
Q6,Q10	104532	23207	Transistor, Pwr
Q7-Q9,Q15	104505	23207	Transistor
Q11,Q14	104527	23207	Transistor
Q12	104547-G1	23207	Transistor, MOSFET
Q13	104506	23207	Transistor
R1	RCR07G226J	81349	Res, 22 Meg, 5%, 1/4W
R2	RCR07G474J	81349	Res, 470K, 5%, 1/4W
R3	RCR07G105J	81349	Res, 1 Meg, 5%, 1/4W
R4	RCR07G106J	81349	Res, 10 Meg, 5%, 1/4W
R5	RCR07G203J	81349	Res, 20K, 5%, 1/4W
R7-R12,R16, R20,R25,R33	RCR07G102J	81349	Res, 1K, 5%, 1/4W

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REPLACEABLE PARTS LIST

MAIN PROCESSSOR BOARD P/N 110356-G1 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R13,R15,R31 R34,R39	RCR07G202J	81349	Res, 2K, 5%, 1/4W
R14	104766-G6	23207	Res, 0.681 ohm, 1%, 3W
R17	RCR07G132J	81349	Res, 1.3K, 5%, 1/4W
R18,R28	104700-G3	23207	Res, Var, 1K, 10%, 1/2W
R19	RCR07G472J	81349	Res, 4.7K, 5%, 1/4W
R22	RCR07G512J	81349	Res, 5.1K, 5%, 1/4W
R23	RCR07G271J	81349	Res, 270 ohms, 5%, 1/4W
R24	RCR07G104J	81349	Res, 100K, 5%, 1/4W
R26	RCR07G621J	81349	Res, 620 ohms, 5%, 1/4W
R27	RN55C3011F	81349	Res, 3.01K, 1%, 1/10W
R29	RN55C6041F	81349	Res, 6.04K, 1%, 1/10W
R30,R33,R45	RCR07G103J	81349	Res, 10K, 5%, 1/4W
R32	RCR07G471J	81349	Res, 470 ohms, 5%, 1/4W
R35	104701-G7	23207	Res, Var, 5K, 10%, 1/2W
R36	RN55C1212F	81349	Res, 12.1K, 1%, 1/10W
R37	RN55C1211F	81349	Res, 1.21K, 1%, 1/10W
R40,R41	RCR07G100J	81349	Res, 10 ohms, 5%, 1/4W
R44	RCR07G392J	81349	Res, 3.9K, 5%, 1/4W
RN1	104799-G1	23207	Res Ntwk, 51K
S1	104851	23207	Switch, Rotary
S2	104816-G2	23207	Switch, P.B., Mom w/Red Button

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REPLACEABLE PARTS LIST

MAIN PROCESSSOR BOARD P/N 110356-G1 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
T1	104640	23207	Transformer
U1	104250	23207	IC, CMOS Counter
U2	104239-G1	23207	IC, Microprocessor
U3	104235	23207	IC, CMOS RAM
U5	104271-G2	23207	IC, Octal Latch
U6,U8,U9,U11	See Program Listing 105910	23207	IC, PROM
U12	104388-G2	23207	IC, CMOS Decoder
U13	104392-G5	23207	IC, CMOS Dual 4-Input NAND Gate
U14,U27-U31	104202-G3	23207	IC, CMOS Quad Latch
U15	104271-G1	23207	IC, CMOS Tri 3-Input OR Gate
U16	104388-G1	23207	IC, CMOS Decoder
U17	104271-G9	23207	IC, CMOS Hex Inverter
U18	104201-G1	23207	IC, CMOS Dual Flip-Flop
U19	104387	23207	IC, CMOS Buffer
U20,U21	104225-G2	23207	IC, CMOS Hex Latch
U22-U26	104222-G4	23207	IC, Driver
U32	104223-G1	23207	IC, Op Amp

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REPLACEABLE PARTS LIST

MAIN PROCESSSOR BOARD P/N 110356-G1 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
U33	104321	23207	IC, Sw. Reg.
U34	104209	23207	IC, -12V Reg.
U35	104253-G1	23207	IC, +12V Reg.
Y1	107546-G1	23207	Crystal, 32.768 KHz
Y2	107454	23207	Crystal, 5.0688 MHz
XU2	104935	23207	Socket, 40 Pin
XU3, XU6-U11	104933	23207	IC Socket, 24 Pin

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REPLACEABLE PARTS LIST

ANALOG BOARD A3, P/N 110362-G1, -G2

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
C1,C2,C4	104017-G2	23207	Cap, 27 pf, 5%, 500V
C3,C15	104026-G4	23207	Cap, 10 pf ±1/2 pf, 500V
C6,C7,C16-C20, C22-C24,C28-C54	103208-G4	23207	Cap, 0.1 uf, 20%, 50V
C8,C9	104076-G2	23207	Cap, 4700 pf, 10%
C10	104076-G1	23207	Cap, 3300 pf, 10%
C11,C12	104017-G1	23207	Cap, 22 pf, 5%, 500V
C13,C14,C27	103209-G2	23207	Cap, 0.22 uf, 20%, 50V
C25,C26	104016-G4	23207	Cap, 20 pf, 5%, 500V
CR1,CR2	102899	23207	Diode, Hot Carrier
CR3-CR17	104412-G2	23207	Diode
J1	207158-2	00779	6 Pin Header
J2-J4	9-350258-1	00779	6 Pin Header
J5	102160-8	00779	34 Pin Rt Angle Conn.
Used @ J5	102312-2	00779	Connector Latch (2)
J6	87543-5	00779	10 Pin Header
	2-530153-2*	00779	Shorting Strap
K1,K2	110751-G1*	23207	Reed Relay
R5,R12,R19	104701-G1	23207	Res, Var, 2K, 10%, 1/2W
R6,R13,R20,R27 R28,R34,R35,R41, R42,R62	104701-G7	23207	Res, Var. 5K, 10%, 1/2W

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*Used in G2 version only

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REPLACEABLE PARTS LIST

ANALOG BOARD P/N 110362-G1, -G2 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R7,R14,R21,R26 R29,R33,R36,R40, R43,R63	RN55C9762F	81349	Res, 97.6K, 1%, 1/10W
R22-R25,R30-R32, R37-R39,R44,R65	RN55C1003F	81349	Res, 100K, 1%, 1/10W
R45	RN55C8062F	81349	Res, 80.6K, 1%, 1/10W
R46,R50	RN55E1003B	81349	Res, 100K, 0.1%, 1/10W
R47,R52	RN55C3012C	81349	Res, 30.1K, 0.25%, 1/10W
R48,R51	RN55C8252C	81349	Res, 82.5K, 0.25%, 1/10W
R49	RN55C1274C	81349	Res, 1.27 Meg, 0.25%, 1/10W
R53	RN55C1182C	81349	Res, 11.8K, 0.25%, 1/10W
R54	RN55C1822F	81349	Res, 18.2K, 1%, 1/10W
R55	104700-G3	23207	Res, Var, 1K, 10%, 1/2W
R56,R58	RN55C1002F	81349	Res, 10K, 1%, 1/10W
R57	RN55C2001F	81349	Res, 2K, 1%, 1/10W
R59	RN55C9761F	81349	Res, 9.76K, 1%, 1/10W
R60	104701-G6	23207	Res, Var, 500 ohms, 10%, 1/10W
R61,R68, R70,R76	RCR07G202J	81349	Res, 2K, 5%, 1/4W
R64	RN55C6342F	81349	Res, 63.4K, 1%, 1/10W
R66	104700-G4	23207	Res, Var, 10K, 10%, 1/2W

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REPLACEABLE PARTS LIST

ANALOG BOARD P/N 110362-G1, -G2 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R67	RCR07G104J	81349	Res, 100K, 5%, 1/4W
R69,R71,R77	RCR07G102J	81349	Res, 1K, 5%, 1/4W
R72,R75,R78	RCR07G204J	81349	Res, 200K, 5%, 1/4W
R73,R74,R79, R87	RCR07G303J	81349	Res, 30K, 5%, 1/4W
R80	RCR07G106J	81349	Res, 10 Meg, 5%, 1/4W
R81	RN558662C	81349	Res, 86.6K, 0.25%, 1/10W
R82,R84	RN55C4753C	81349	Res, 475K, 0.25%, 1/10W
R83,R85	RN55C3243C	81349	Res, 324K, 0.25%, 1/10W
R86	RN55C5111F	81349	Res, 5.11K, 1%, 1/10W
R88	RN55C2002F	81349	Res, 20K, 1%, 1/10W
RN1	104799-G2	23207	Res Ntwk, 100K, 2%
RN2-RN4	104740	23207	Res Ntwk
TB1,TB2	104205-NL	52458	5 Pos. Term Block
U1-U4	104276-G1	23207	IC, OP Amp, JFET
U5,U6,U9 U11,U12	104255-G1	23207	IC, CMOS, Quad Analog Switch
U7,U13	104236-G2	23207	IC, Op Amp, JFET
U8,U10,U14	104256-G2	23207	IC, Sample & Hold
U15,U16,U18	104256-G1	23207	IC, Op Amp, HI SR
U17	104257-G1	23207	IC, Comparator
U19	104201-G1	23207	IC, CMOS, Dual Flip-Flop

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REPLACEABLE PARTS LIST

ANALOG BOARD P/N 110362-G1, -G2 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
U20	104258-G1	23207	IC, DAC
U21	104259-G1	23207	IC, CMOS SAR
U22,U23, U41-U43	104387-G1	23207	IC, CMOS Tri-state Buffer
U24-U29,U31	104202-G3	23207	IC, CMOS Quad Latch
U30	104222-G4	23207	IC, Buffer/Driver
U32,U33,U35	104333	23207	IC, Opto-Coupler
U34	104200-G5	23207	IC, Quad NAND Gate
U36	104217-G2	23207	IC, Dual Counter
U37	See Program Listing 105910	23207	IC, PROM
U39	104225-G7	23207	IC, CMOS Octal Latch
U40	104388-G1	23207	IC, Decoder
U44	104239-G1	23207	IC, CMOS Microprocessor
U45	104231-G2	23207	IC, Quad NAND Gate
U46	104384-G2	23207	IC, Voltage Reg.
Y1	107454	23207	5.0688 MHz Crystal
XU1-XU4, XU7-XU13	104927	23207	8 Pin IC Socket
XU20	110749	23207	16 Pin IC Socket
XU21,XU37	104933	23207	24 Pin IC Socket
XU44	104935	23207	40 Pin IC Socket
XK1,XK2	104928	23207	14 Pin IC Socket

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REPLACEABLE PARTS LIST

POWER TRANSFORMER BOARD A4, P/N 111817-G3

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
S1	104880	23207	Switch, 2PDT Slide
T1	104639	23207	Transformer, 115/230V

REPLACEABLE PARTS LIST

PRINTER ASSY A5, P/N 110345-G1, G2

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
A1	110600	23207	Flex Cable Assy
	110341	23207	Harness
	110349*	23207	Door Latch (2)
	111321*	23207	Printer Door
	110311**	23207	Printer Door
	110313**	23207	Printer Mounting Plate
	110314	23207	Motor Support Brkt
	110315	23207	Motor Arm
	103624	23207	Platen
	110317**	23207	Panel Stiffener
	110318	23207	Torsion Ring
	110348*	23207	Door Keeper (2)
	110320**	23207	Paper Spool Support
	110321**	23207	Spool Spring

*Used in G1 version only
**Used in G2 version only

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REPLACEABLE PARTS LIST

PRINTER ASSY A5, P/N 110345-G1, G2 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
	110323	23207	Printer and Switch Support Brkt
	110324	23207	Printer and Motor Support Brkt
	103640**	23207	Hinge
	103622	23207	Pressure Clamp
	110605**	23207	Printer Shim (2)
	103641**	23207	Spring Paper Holder (2)
	103625	23207	Printhead Shaft
	103626	23207	Print Roller Shaft (2)
	103628-G2	23207	Printer Left Spring
	103627-G2	23207	Printer Right Spring
B1	103699	23207	Stepping Motor Assy
	103631	23207	Pinch Roller (2)
	103604	23207	Thermal Printhead
	103633	23207	Printhead Substrate Support
	110374	23207	Paper Guide
	110332**	23207	Printer Door Overlay
	111322*	23207	Door Knob
B2	RS365-1885	Mabuchi	DC Motor

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PRINTER ASSY A5, P/N 110345-G1, G2 (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
P2	640442-4	00779	Connector
S1	104845	23207	Low Torque Switch
	HN3P-34-1**	83014	Plunger (2)
	110319-G1	23207	Paper Spool
	110707-G1	23207	Pully
	107542-G1	23207	"O" Ring
		Either/Or	
	110319-G2	23207	Paper Spool
	110707-G2	23207	Pulley
	107542-G2	23207	"O" Ring
	110604	23207	Grooved Pin S/M
	107487	23207	Nylon Bushing
	PS094032	62806	Push On Fastener
	110645	23207	Motor Damper Brkt
	111012*	23207	Spool, Spring
	111014*	23207	Paper Spool Support
	111013*	23207	Spring Paper Holder (2)
	110890	23207	Printer Shaft Retainer (2)

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**Used in G2 version only

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SECTION VII

SCHEMATIC DIAGRAMS AND ASSEMBLY DRAWINGS

The drawings in this section contain the schematic and wiring diagrams as well as the assembly drawings of the equipment comprising the Series 808 Electric Power Demand Analyzer. The schematic and wiring diagrams supplement the Theory of Operation and Maintenance sections (IV and V, respectively) of this manual. The assembly drawings illustrate and locate the parts referenced in the Replaceable Parts List (Section VI).

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I.C. CHART						
REF. DESIG	DESCRIPTION	+5V	+12V	GND	+VD	-VD
U1, 2, 3	CD4053		16	8		
U4-U13	CD4094				16	8
U14, U15	CD4042	16		8		
U16, U17, U26	MM74C906N	14		7		
U19	SN75468N			8		
U20	MM74C174N	16		8		
U21	MM80C97N	16		8		
U22	CD4013	14		7		
U23	CD4011		14	7		
U24	TL062ACP		8	4		
U25	MD74SC138AE	16		8		
U27	GE 94E3R326					
U28	UA7812C					

NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE 1/4W. 5%
2. ALL CAPACITOR VALUES ARE IN MICROFARADS
3 ALL DIODES ARE IN4148

SPARES

Figure 7-1. Keyboard/Display Board P/N 110350, Schematic Diagram 110355 (Rev. C)

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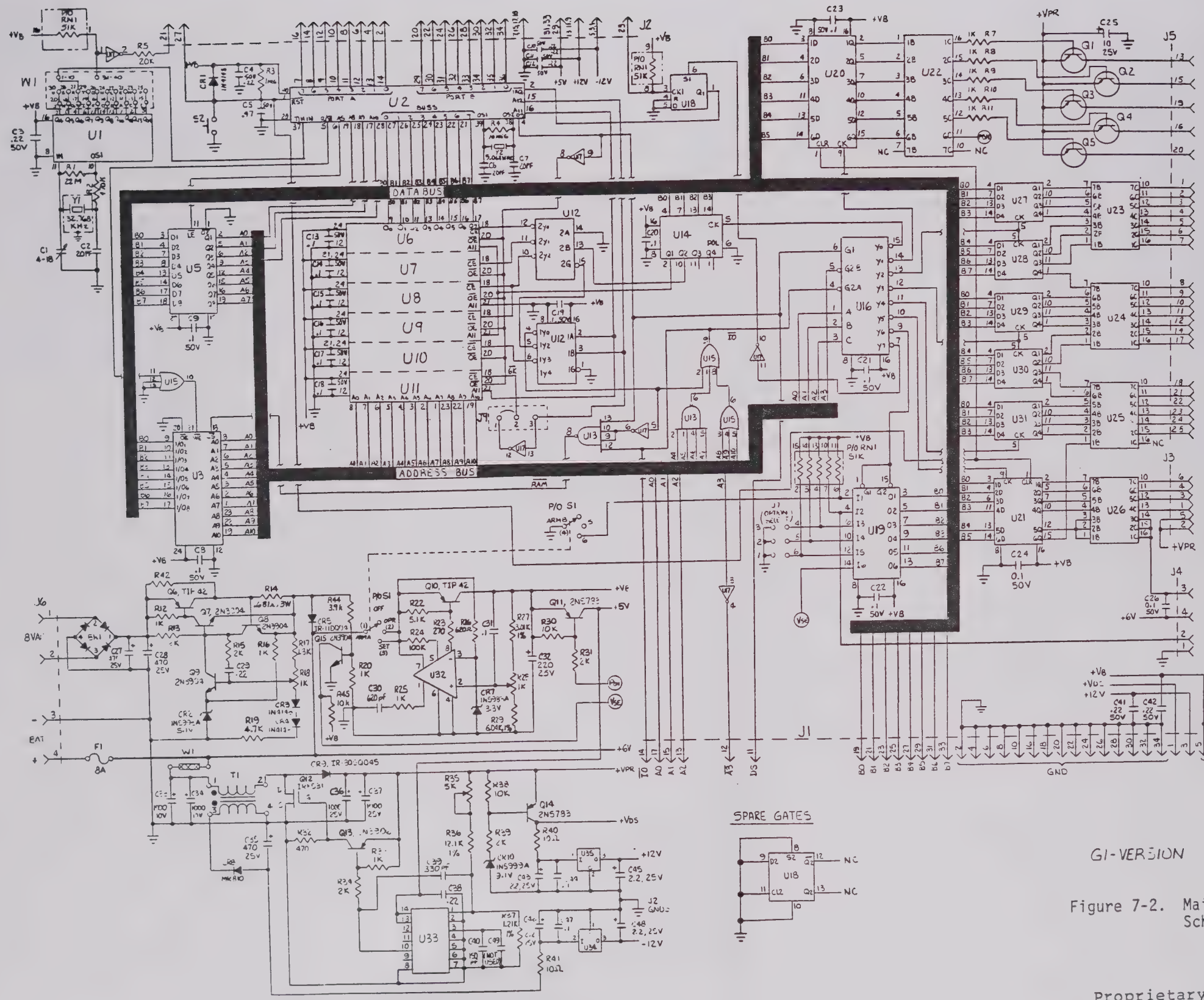

DESIG.	TYPE	GND.	+V8	+12V.	+VPR	+5V.	-12V.
U6	27C64	12	24				
U8. U9	27C64	12	24				
U11	27C64	12	24				
U1	CD4060BE	8 12	16				
U2	MC146805E2	20	40				
U3	MM6116LH-4	12	24				
U5	MM74HC373N	1,10	20				
U12	74SC139N	1,8	16				
U13	MM74HC20N	7	14				
U14	CD4042FE	6,8	16				
U16	74SC138	8	16				
U18	CD4013BE	4,5,7	14				
U19	MM90C97N	8	16				
U21,24,25,26	75468	8				9	
U27,28,29,30,31	CD4042BE	6,8	16				
U32	CA3094E	4,6					
U33	TL497ACN	2,4,5				14	
U34	UA7912C	1					3
U35	UA7812C	2		3			
U15	MM74HC40TN	7	14				
U17	MM74HC04N	7	14				
U20, U22	74C174N	8	16				

OSC OUTPUT FREQUENCY		
Q4 2048 HZ	Q8 128 HZ	Q12 8 HZ
Q5 1024 HZ	Q9 64 HZ	Q13 4 HZ
Q6 512 HZ	Q10 32 HZ	Q14 2 HZ
Q7 256 HZ		

Figure 7-2. Main Processor Board P/N 110356-G( ), Schematic Diagram 110361-G1 (Rev. M)

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I.C. TABLE					
DESIG	TYPE	+12V	-12V	+5V	GND
U1-U4	LF442ACN	3	4	-	-
U5, U6, U9, U11, U12	HI3-201-5	13	4	-	5
U7, U13	TL062ACP	8	4	-	-
U8, U10, U14	LF398N	1	4	-	7
U15, U16, U18	LF356	7	4	-	-
U17	LM319	11	6	-	3, 8
U19	CD4013	-	-	14	7
U20	AD7533	14	-	-	3
U21	MM74C905	-	-	24	12
U22, U23	80C97	-	-	16	8
U24 - U29	CD4042	-	-	16	8
U30	75468	9	-	-	8
U31	CD4042	-	-	16	8
U32, U33, U35,	MCT273	-	-	-	-
U34	CD4011	-	-	14	7
U36	MC14520	-	-	16	8
U38	27C16	-	-	24	12
U39	MM74C373	-	-	20	10
U40	74SC138	-	-	16	8
U41, U42, U43	80C97	-	-	16	8
U44	MC146805E2	-	-	40	20
U45	SN74C00	-	-	14	7
U46	LM329KZ	-	-	-	-
U37,	27C32	-	-	24	12

SPARE GATES:

NOTES:
UNLESS OTHERWISE SPECIFIED:
1. RESISTANCE VALUES ARE IN OHMS 1/4 W ± 5%.
2. CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE IN4148
4. COMPONENTS IN PHANTOM BOX ARE 32 VERSION ONLY
5. U38 IS NOT USED.

Figure 7-3. Analog Board P/N 110362-G( ), Schematic Diagram 110367-G( ), Rev. G

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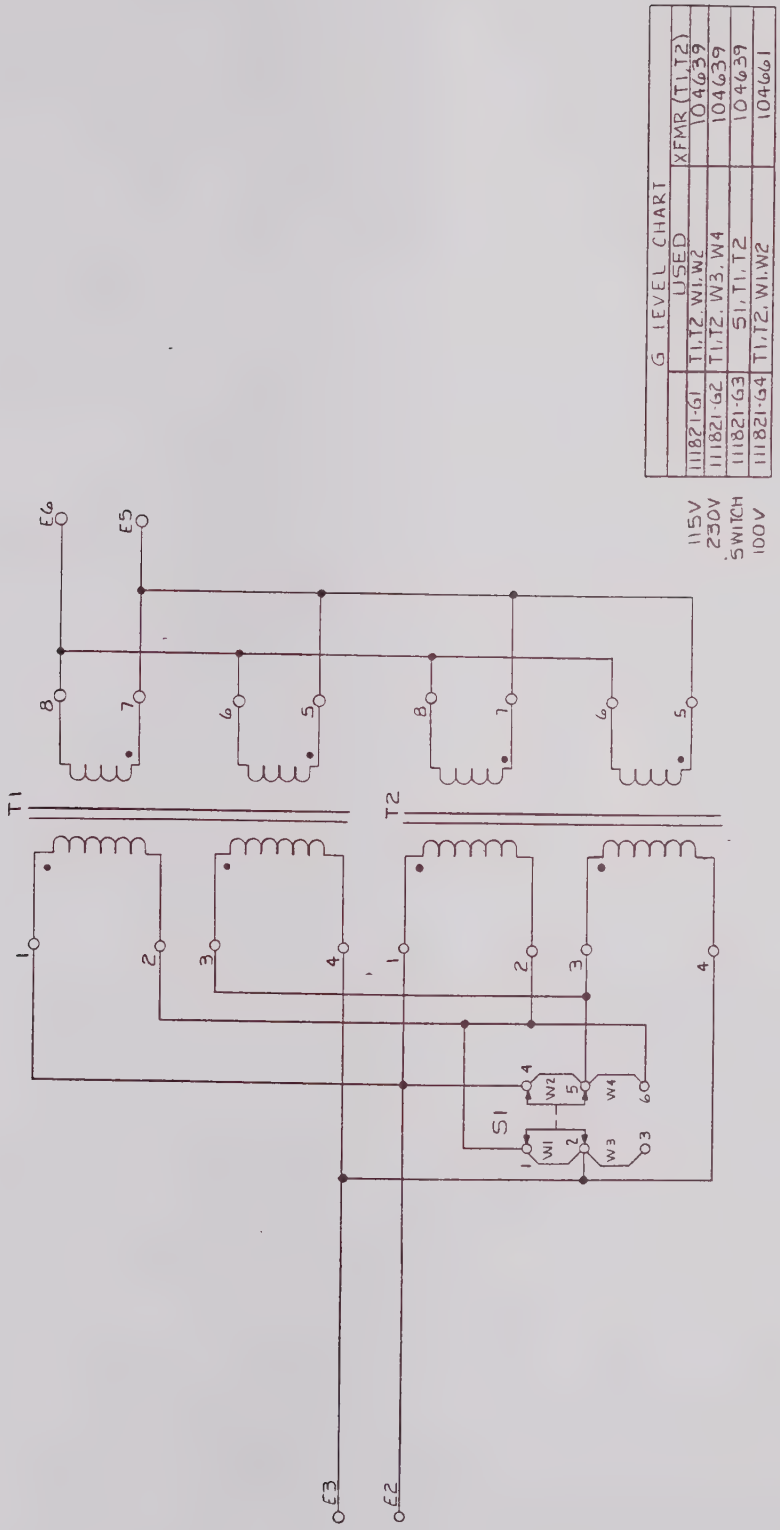

Figure 7-4. Power Transformer Board P/N 111817-G( ), Schematic Diagram 111821-G( ), Rev. B

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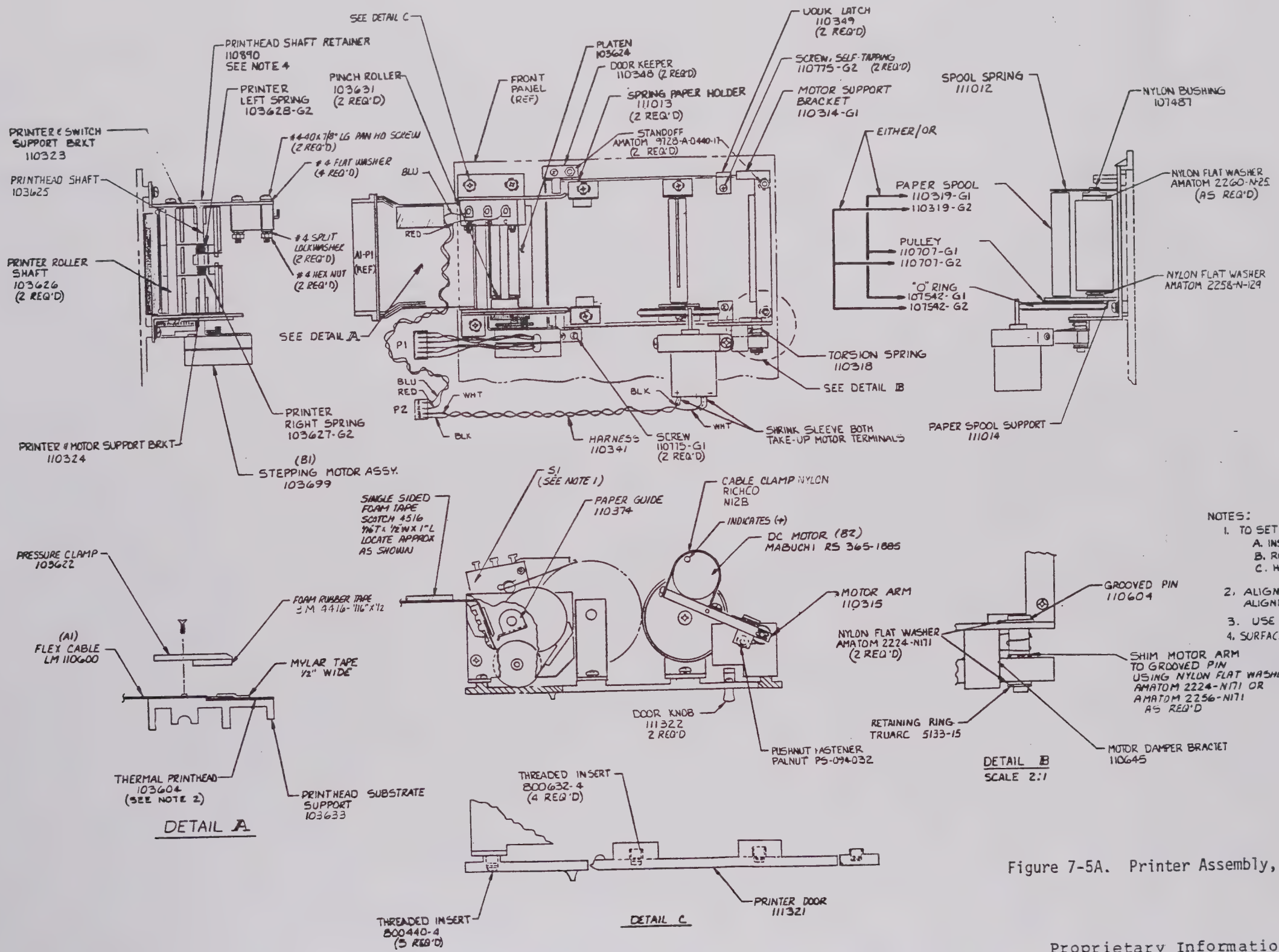
SEE DETAIL C
PRINTHEAD SHAFT RETAINER 110890 SEE NOTE 4
PRINTER LEFT SPRING 103628-G2
PINCH ROLLER 103631 (2 REQ'D)
FRONT PANEL (REF)
PLATEN 103624
DOOR KEEPER 110348 (2 REQ'D)
SPRING PAPER HOLDER 111013 (2 REQ'D)
DOOR LATCH 110349 (2 REQ'D)
SCREW, SELF-TAPPING 110775-G2 (2 REQ'D)
MOTOR SUPPORT BRACKET 110314-G1
SPOOL SPRING 111012
NYLON BUSHING 107487
PRINTER & SWITCH SUPPORT BRKT 110323
#4-40 x 7/8" LG PAN HD SCREW (2 REQ'D)
#4 FLAT WASHER (4 REQ'D)
STANDOFF AMATOM 9128-A-0440-17 (2 REQ'D)
EITHER/OR
PAPER SPOOL 110319-G1 110319-G2
NYLON FLAT WASHER AMATOM 2260-N-25 (AS REQ'D)
PRINTHEAD SHAFT 103625
#4 SPLIT LOCKWASHER (2 REQ'D)
#4 HEX NUT (2 REQ'D)
BLU
RED
A1-P1 (REF)
PULLEY 110707-G1 110707-G2
"O" RING 107542-G1 107542-G2
NYLON FLAT WASHER AMATOM 2258-N-129
PRINTER ROLLER SHAFT 103626 (2 REQ'D)
SEE DETAIL A
P1
TORSION SPRING 110318
SEE DETAIL B
BLU
RED
WHT
P2
BLK
BLK
WHT
PRINTER RIGHT SPRING 103627-G2
HARNESS 110341
SCREW 110715-G1 (2 REQ'D)
SHRINK SLEEVE BOTH TAKE-UP MOTOR TERMINALS
PAPER SPOOL SUPPORT 111014
PRINTER & MOTOR SUPPORT BRKT 110324
(B1) STEPPING MOTOR ASSY. 103699
S1 (SEE NOTE 1)
CABLE CLAMP NYLON RICHCO N12B
SINGLE SIDED FOAM TAPE SCOTCH 4516 1/16T x 1/2W x 1"L LOCATE APPROX AS SHOWN
PAPER GUIDE 110374
INDICATES (+)
DC MOTOR (B2) MABUCHI RS 365-1885
PRESSURE CLAMP 103622
FOAM RUBBER TAPE 3M 4416-116"x1/2
MOTOR ARM 110315
(A1) FLEX CABLE LM 110600
MYLAR TAPE 1/2" WIDE
DOOR KNOB 111322 2 REQ'D
PUSHNUT FASTENER PALNUT PS-094-032
THERMAL PRINTHEAD 103604 (SEE NOTE 2)
PRINTHEAD SUBSTRATE SUPPORT 103633
DETAIL A
THREADED INSERT 800632-4 (4 REQ'D)
PRINTER DOOR 111321
THREADED INSERT 800440-4 (3 REQ'D)
DETAIL C
GROOVED PIN 110604
NYLON FLAT WASHER AMATOM 2224-N171 (2 REQ'D)
SHIM MOTOR ARM TO GROOVED PIN USING NYLON FLAT WASHER AMATOM 2224-N171 OR AMATOM 2256-N171 AS REQ'D
RETAINING RING TRUARC 5133-15
MOTOR DAMPER BRACKET 110645
DETAIL B
SCALE 2:1
NOTES:
1. TO SET S1 ;
A. INSTALL CALIBRATED PAPER ROLL
B. ROTATE S1 UNTIL ACTUATOR TRIPS SWITCH
C. HOLD THIS POSITION & TIGHTEN S1 IN PLACE.
2. ALIGN PRINTHEAD TO FLEX-CABLE USING ALIGNMENT PROCEDURE 110316
3. USE ARBOR PRESS TO INSTALL ALL THREADED INSERTS
4. SURFACE MUST BE FREE OF MACHINE OIL, GREASE, DIRT, ETC PRIOR TO INSTALLING RETAINER.

Figure 7-5A. Printer Assembly, P/N 110345-G1 (Rev. P)

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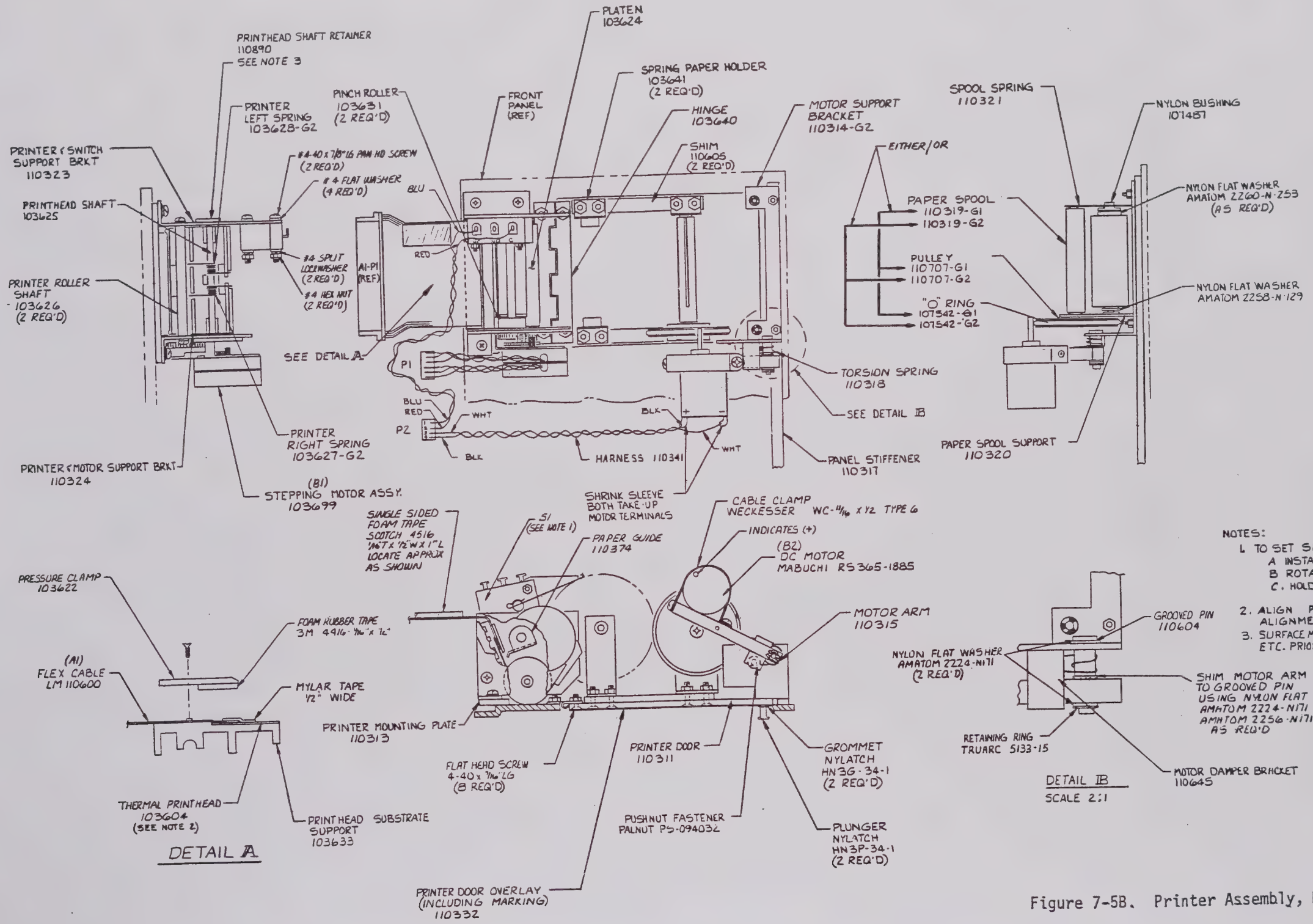
PRINTHEAD SHAFT RETAINER 110890 SEE NOTE 3
PLATEN 103624
SPRING PAPER HOLDER 103641 (2 REQ'D)
PINCH ROLLER 103631 (2 REQ'D)
FRONT PANEL (REF)
HINGE 103640
MOTOR SUPPORT BRACKET 110314-G2
SPOOL SPRING 110321
NYLON BUSHING 101457
PRINTER LEFT SPRING 103628-G2
#4-40 x 7/8" LG PAN HD SCREW (2 REQ'D)
#4 FLAT WASHER (4 REQ'D)
SHIM 110605 (2 REQ'D)
EITHER/OR
PRINTER & SWITCH SUPPORT BRKT 110323
PRINTHEAD SHAFT 103625
#4 SPLIT LOCKWASHER (2 REQ'D)
#4 HEX NUT (2 REQ'D)
BLU
RED
A1-P1 (REF)
PAPER SPOOL 110319-G1 110319-G2
NYLON FLAT WASHER AMATOM ZZ60-N-253 (AS REQ'D)
PULLEY 110707-G1 110707-G2
"O" RING 107542-G1 107542-G2
NYLON FLAT WASHER AMATOM ZZ58-N-129
PRINTER ROLLER SHAFT 103626 (2 REQ'D)
SEE DETAIL A
P1
TORSION SPRING 110318
SEE DETAIL B
BLU
RED
WHT
BLK
P2
BLK
HARNESS 110341
WHT
PRINTER RIGHT SPRING 103627-G2
PANEL STIFFENER 110317
PAPER SPOOL SUPPORT 110320
PRINTER & MOTOR SUPPORT BRKT 110324
(B1) STEPPING MOTOR ASSY. 103699
SHRINK SLEEVE BOTH TAKE-UP MOTOR TERMINALS
CABLE CLAMP WECKESSER WC-11/16 x Y2 TYPE G
INDICATES (+)
(B2) DC MOTOR MABUCHI RS365-1885
SINGLE SIDED FOAM TAPE SCOTCH 4516 .06"T x .12"W x 1"L LOCATE APPROX AS SHOWN
S1 (SEE NOTE 1)
PAPER GUIDE 110374
MOTOR ARM 110315
PRESSURE CLAMP 103622
FOAM RUBBER TAPE 3M 4416 .06" x .12"
(A1) FLEX CABLE LM 110600
MYLAR TAPE 1/2" WIDE
PRINTER MOUNTING PLATE 110313
PRINTER DOOR 110311
GROMMET NYLATCH HN3G-34-1 (2 REQ'D)
FLAT HEAD SCREW 4-40 x 7/16" LG (8 REQ'D)
PUSHNUT FASTENER PALNUT PS-094032
PLUNGER NYLATCH HN3P-34-1 (2 REQ'D)
THERMAL PRINTHEAD 103604 (SEE NOTE 2)
PRINTHEAD SUBSTRATE SUPPORT 103633
PRINTER DOOR OVERLAY (INCLUDING MARKING) 110332
DETAIL A
NOTES:
1. TO SET S1:
A INSTALL CALIBRATED PAPER ROLL
B ROTATE S1 UNTIL ACTUATOR TRIPS SWITCH
C. HOLD THIS POSITION & TIGHTEN S1 IN PLACE
2. ALIGN PRINTHEAD TO FLEX-CABLE USING ALIGNMENT PROCEDURE 110336.
3. SURFACE MUST BE FREE OF ALL SURFACE OIL, GREASE, DIRT, ETC. PRIOR TO INSTALLING RETAINER.
GROOVED PIN 110604
NYLON FLAT WASHER AMATOM 2224-N171 (2 REQ'D)
SHIM MOTOR ARM TO GROOVED PIN USING NYLON FLAT WASHER AMATOM 2224-N171 OR AMATOM 2256-N171 AS REQ'D
RETAINING RING TRUARC 5133-15
MOTOR DAMPER BRACKET 110645
DETAIL B
SCALE 2:1

Figure 7-5B. Printer Assembly, P/N 110345-G2 (Rev. P)

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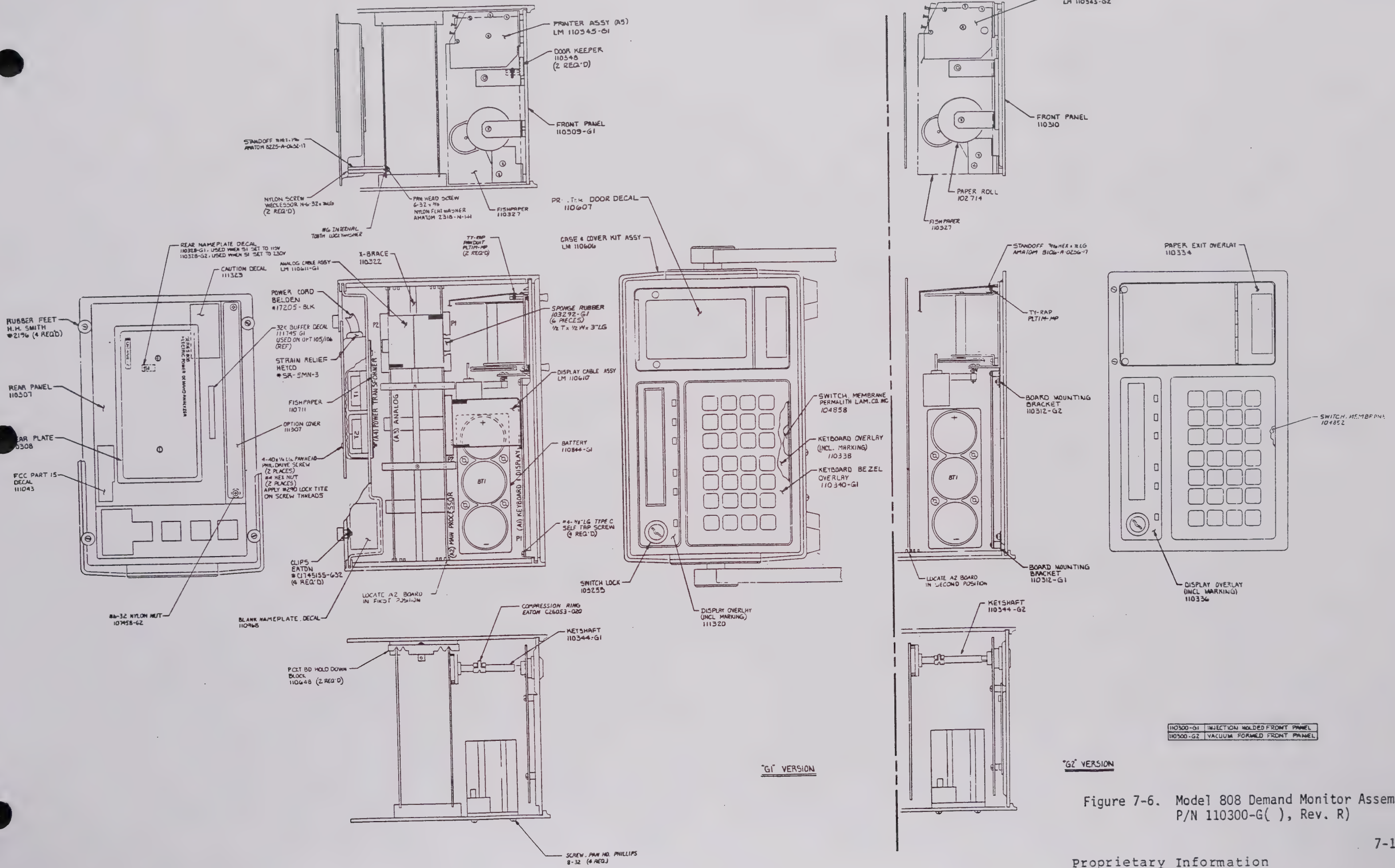
PRINTER ASSY (A5) LM 110345-G1
DOOR KEEPER 110548 (2 REQ'D)
FRONT PANEL 110309-G1
STANDOFF 1/4HEX x 1"LG AMATOM 8225-A-0632-17
NYLON SCREW WECLESSOR M6-32 x 3/8LG (2 REQ'D)
PAN HEAD SCREW 6-32 x 3/8 NYLON FLAT WASHER AMATOM 2318-N-1-H
#6 INTERNAL TOOTH LOCKWASHER
FISHPAPER 110327
PRINTER ASSY (A5) LM 110345-G2
FRONT PANEL 110310
PAPER ROLL 102714
FISHPAPER 110327
PR. ITEM DOOR DECAL 110607
CASE & COVER KIT ASSY LM 110606
REAR NAMEPLATE DECAL 110328-G1, USED WHEN SI SET TO 115V 110328-G2, USED WHEN SI SET TO 230V
CAUTION DECAL 111323
ANALOG CABLE ASSY LM 110611-G1
X-BRACE 110322
TY-RAP PANDUIT PLT1M-MP (2 REQ'D)
POWER CORD BELDEN #17205-BLK
SPONGE RUBBER 103292-G1 (6 PIECES) 1/2 T x 1/2 W x 3"LG
RUBBER FEET H.H. SMITH #2196 (4 REQ'D)
32K BUFFER DECAL 111745 G1 USED ON OPT 105/106 (REF)
STRAIN RELIEF HEYCO #SR-SMN-3
DISPLAY CABLE ASSY LM 110610
REAR PANEL 110307
FISHPAPER 110711
OPTION COVER 111307
BATTERY 110844-G1
4-40 x 1/4 Lg. PAN HEAD PHIL. DRIVE SCREW (2 PLACES) #4 HEX NUT (2 PLACES) APPLY #290 LOCK TITE ON SCREW THREADS
#4-24"LG TYPE C SELF TAP SCREW (4 REQ'D)
FCC PART 15 DECAL 111043
CLIPS EATON #C1745155-632 (4 REQ'D)
LOCATE A2 BOARD IN FIRST POSITION
#6-32 NYLON NUT 107458-G2
BLANK NAMEPLATE DECAL 110486
SWITCH, MEMBRANE PERMALITH LAM. CO. INC 104858
KEYBOARD OVERLAY (INCL. MARKING) 110338
KEYBOARD BEZEL OVERLAY 110340-G1
SWITCH LOCK 103255
DISPLAY OVERLAY (INCL MARKING) 111320
STANDOFF 7/16HEX x 1"LG AMATOM 8106-A-0256-17
PAPER EXIT OVERLAY 110334
TY-RAP PLT1M-MP
BOARD MOUNTING BRACKET 110312-G2
SWITCH, MEMBRANE 104852
LOCATE A2 BOARD IN SECOND POSITION
BOARD MOUNTING BRACKET 110312-G1
DISPLAY OVERLAY (INCL MARKING) 110336
COMPRESSION RING EATON C26053-020
KEYSHAFT 110344-G1
PCB BD HOLD DOWN BLOCK 110648 (2 REQ'D)
SCREW, PAN HD. PHILLIPS 8-32 (4 REQ.)
KEYSHAFT 110344-G2
"G1" VERSION
"G2" VERSION

110300-G1	INJECTION MOLDED FRONT PANEL
110500-G2	VACUUM FORMED FRONT PANEL

Figure 7-6. Model 808 Demand Monitor Assembly P/N 110300-G( ), Rev. R)

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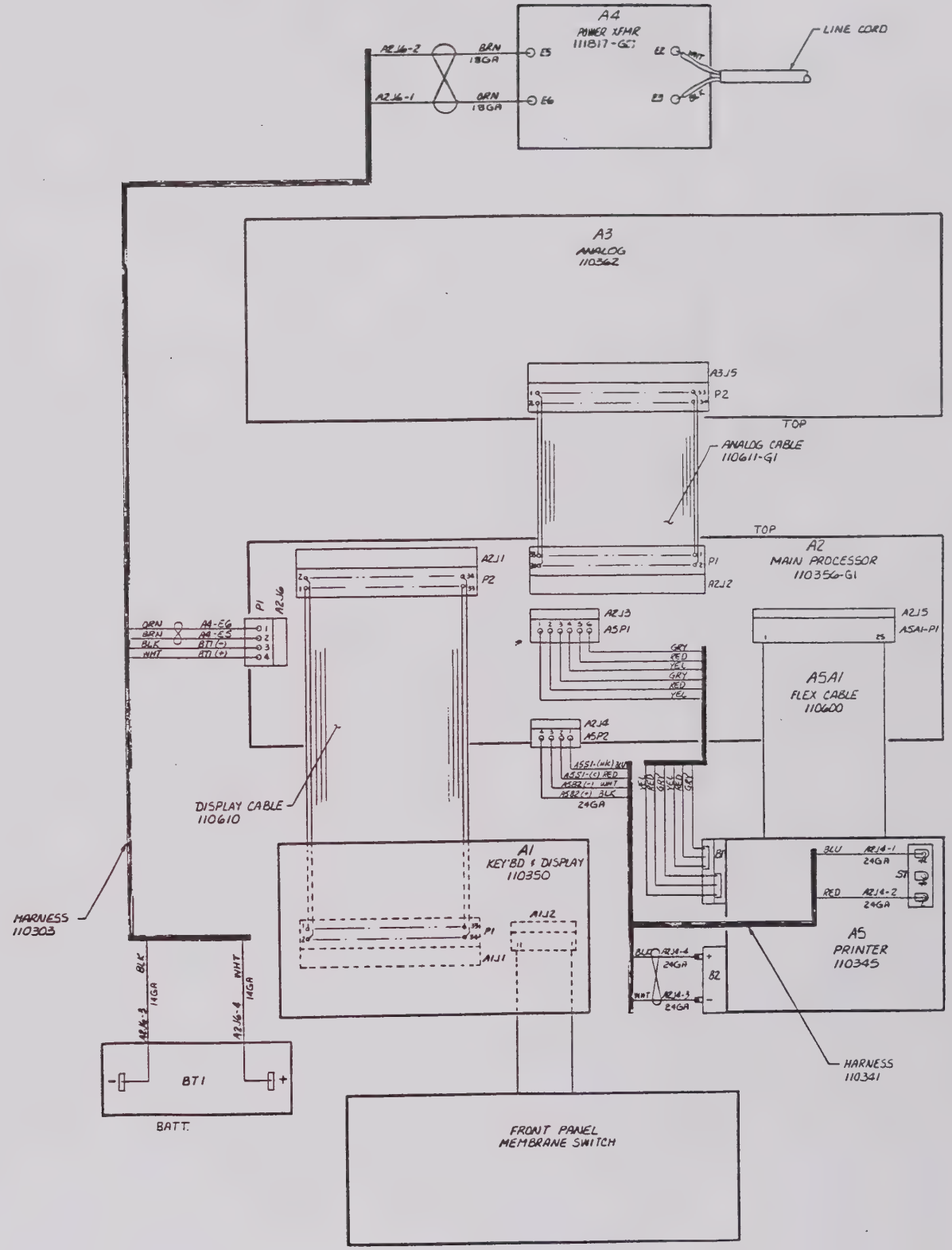

Figure 7-7. 808 Interconnecting Wiring Diagram
110302 (Rev. E)

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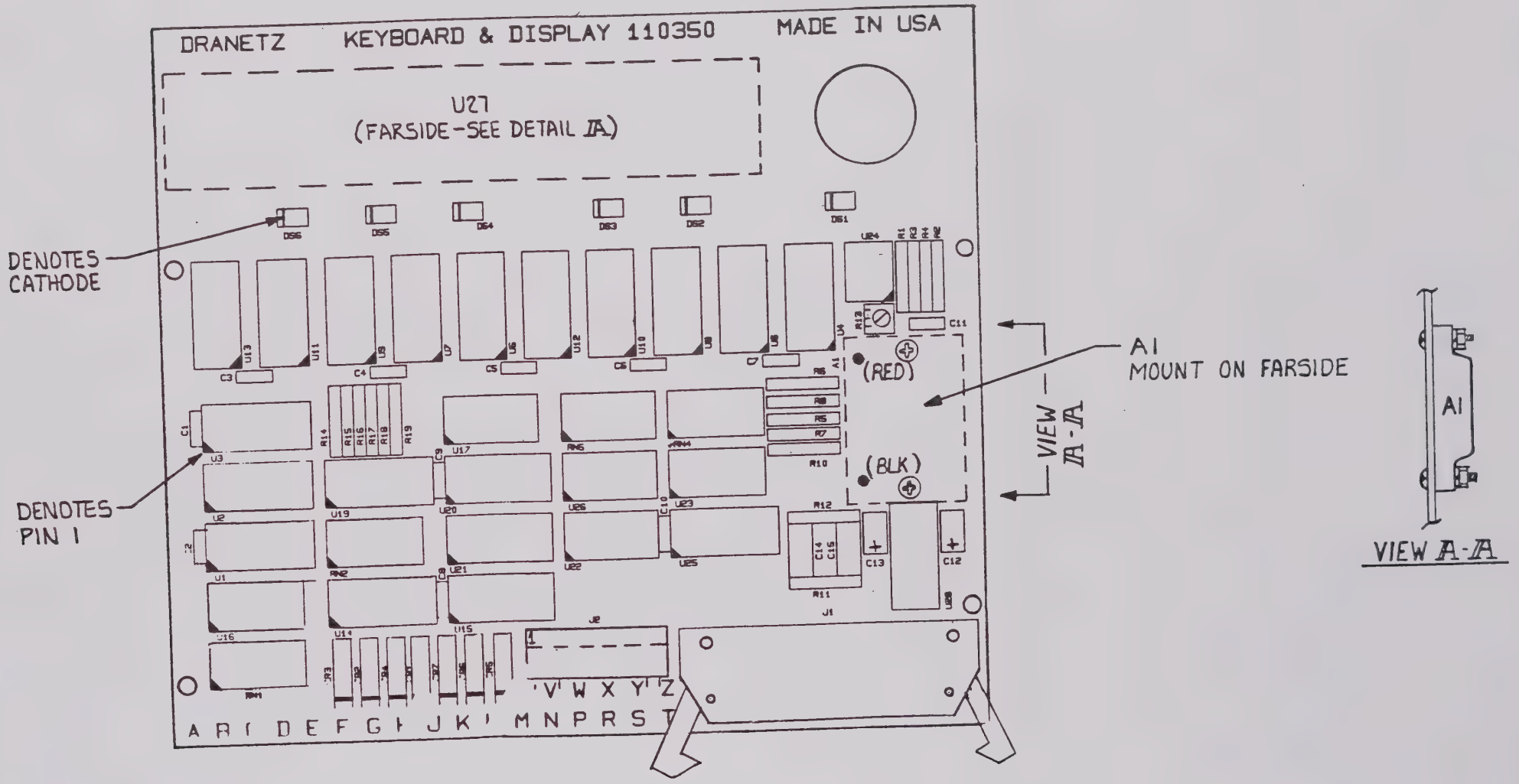

Figure 7-8. Keyboard/Display Board Assembly, P/N 110350, Rev. C_2

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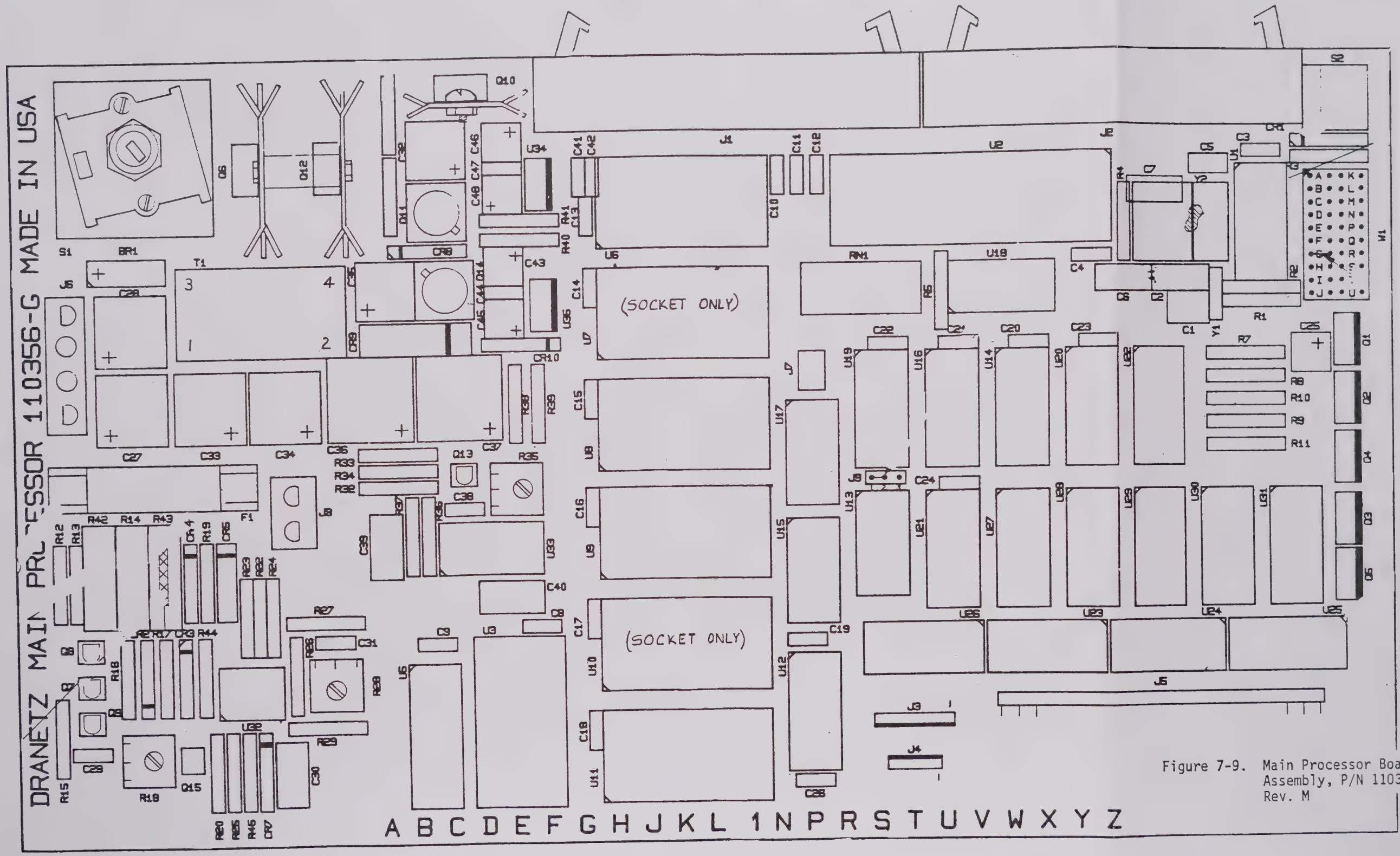

Figure 7-9. Main Processor Board Assembly, P/N 110356-G( ), Rev. M

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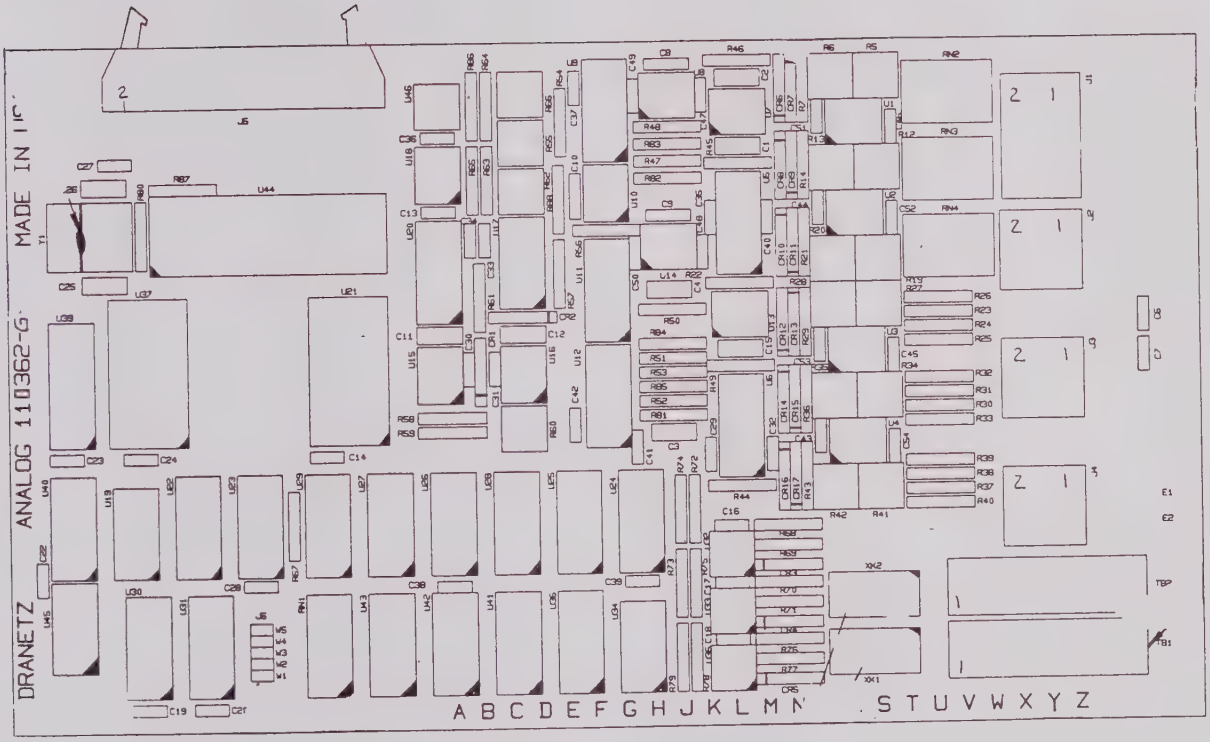

Figure 7-10. Analog Board Assembly, P/N 110362-G( ), Rev. G

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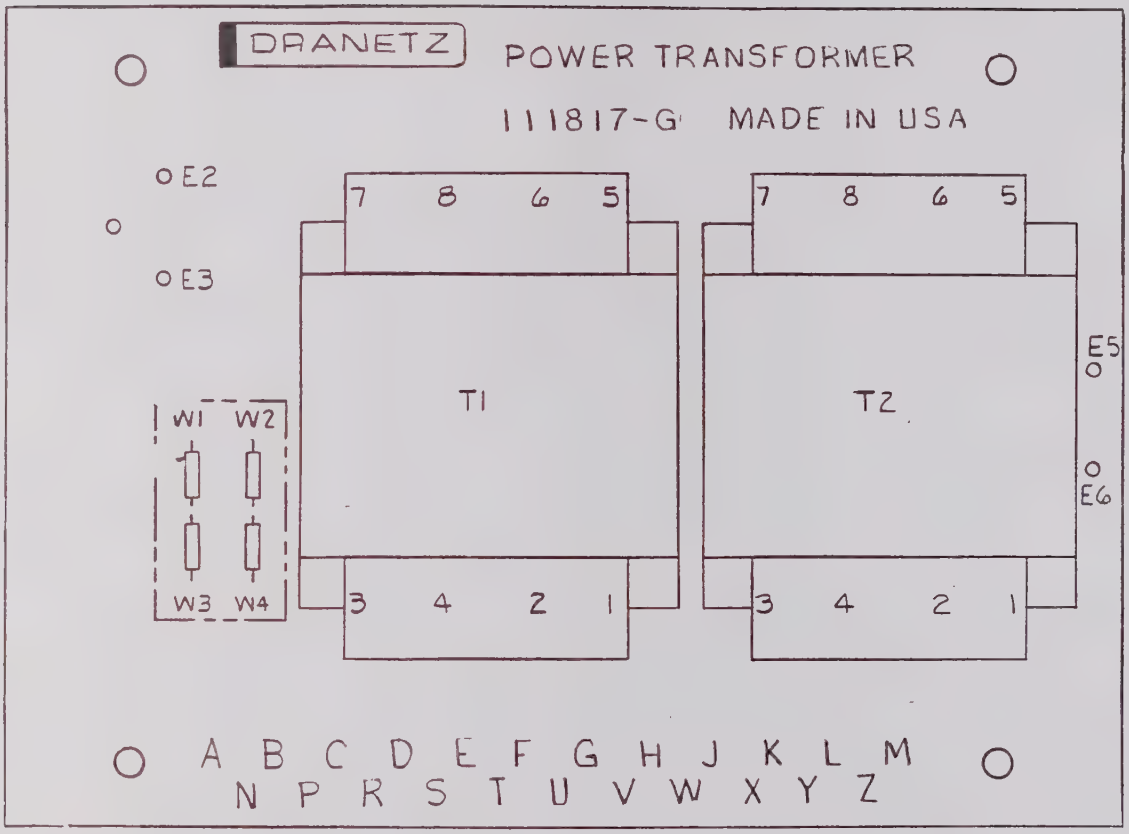

G LEVEL CHART			
		USED	XFMR (T1,T2)
115V	111817-G1	T1,T2,W1,W2	104639
230V	111817-G2	T1,T2,W3,W4	104639
SWITCH	111817-G3	S1,T1,T2	104639
100V	111817-G4	T1,T2,W1,W2	104661

Figure 7-11. Power Transformer Board Assembly, P/N 111817-G( ), Rev. B

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WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

TM-111310-G1/G3

SERVICE MANUAL
VOLUME 2

SERIES 808 COMMUNICATION INTERFACE
OPTIONS 105 & 106

15 December 1985
(Rev. 1 Nov. 1987)

NOTE

Refer to Volume 1 (Operator's Manual) of TM-111310-G1 and TM-111310-G3 for the installation and operation instructions of Options 105 and 106.

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HAWKER DRANETZ SIDDELEY

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VOLUME 2
SERVICE MANUAL

SERIES 808 COMMUNICATION INTERFACE - OPTIONS 105 & 106

SECTION IV
THEORY OF OPERATION

4.1 SCOPE

This volume of the manual contains the service, calibration and maintenance instructions for Options 105 and 106 (Communication Interface) of the Series 808 Electric Power Demand Analyzer. The information in this volume is applicable to both options, unless so indicated. The "G" level chart in figure 7-1, the top assembly drawing of the Series 808 with Options 105 and 106, identifies the assembly numbers of the applicable communication and selector boards.

The following data is organized into four sections: Theory of Operation, Maintenance and Calibration, Replaceable Parts List, and Schematics and Assembly Drawings.

Refer to Volume 1 of TM-111310-G1 and -G3 for the installation and operation instructions for Options 105 and 106, respectively.

4.2 INTRODUCTION

Options 105 and 106 provide external duplex communication for the Series 808. The major difference between the two options is that Option 105 interfaces with an RS-232 port while Option 106 (an updated version of the older Option 104) interfaces with an RS-232 port or a modem.

4.3 FUNCTIONAL DESCRIPTION

The Communication Board (A6) contains almost all of the circuits used by the options. This board is located between the Main Processor board (A2) and the Analog board (A3) of the Series 808. A block diagram of the Communication board appears in figure 4-1 of this manual; the schematic diagram of the board is shown in figure 7-3.

4.3.1 Microprocessor and Address Bus

Microprocessor U1 on the Communication board (a 6303) provides the interface between the communication ports and the 808 Mainframe. Its lower address is multiplexed with the data bus. The lower address bits are latched via the address strobe line: pin 39 of U1 and pin 11 of U2.

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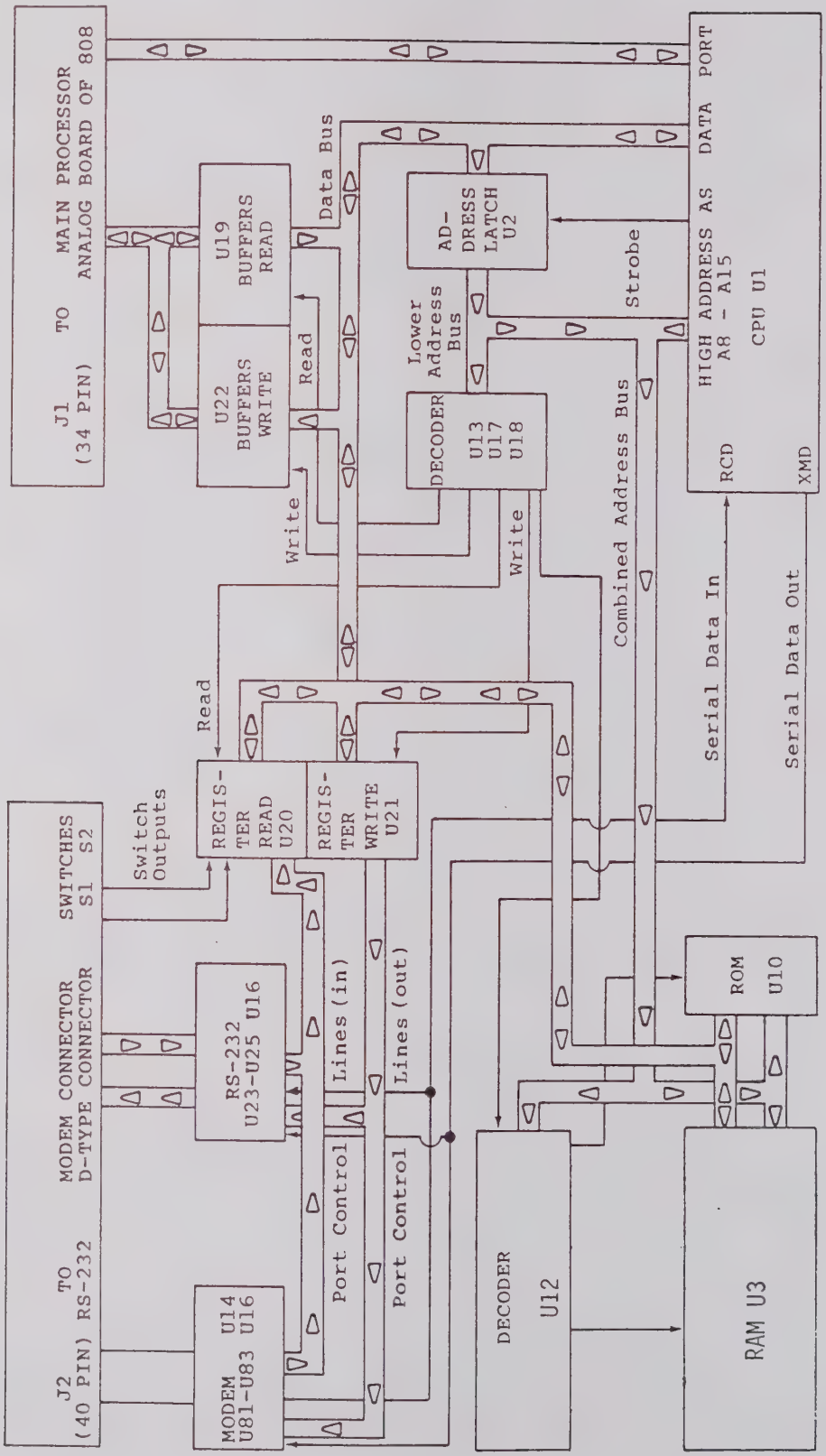

Figure 4-1. Communication Board, Block Diagram

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Once obtained, the lower address bus is combined with the high address bus and used with decoders U12 and U13 to address the remainder of the board. The decoders select RAMs, ROMs, registers U21 and U22, and buffers U19 and U20.

4.3.2 808 Mainframe Interface

All information and data sent to and from the communication board must pass through tristate buffers U19 and U22. U19 reads data from the 808 and U22 writes data back to the 808 system. Processor U1 of the communication board uses the 8-bit I/O port, pins 13 through 20, to determine when to read or write to the 808. Handshaking signals sent over these lines from connector J1 to the I/O port, allow the processor to determine when to enable buffers U19 and U22, along with the data direction.

4.3.3 Memory

Decoder U12 accesses memory. The processor and U12 address RAM U3. In addition to using a small portion of its memory for the prcessor system's overhead, the RAM provides the storage required for the communication interface's character buffer. ROM U10 provides the necessary software for the processor (U1) to operate and control the different on-board systems. Sockets for U9, U8 and J43 are provided for expansion.

4.3.4 Communication Control Lines

The control lines for the two communication ports are provided by the processor (U1) through registers U20 and U21, via the data bus. Buffer U20 provides the processor with the status of rear panel switches S1 hand S2, and the incoming control lines of communication ports DCD, CTS, and DSR. U21 performs the opposite function by allowing the processor to set the status of outgoing control lines. These control lines furnish the necessary data for operation of the modem section, along with setting the logic levels of DTR and RTS. Serial data lines are connected directly to processor pins 11 and 12 of U1. The serial data coming from the communication ports to the processor are applied to pin 11 of U1, while the data being sent from the processor to the ports is derived from pin 12 of U1.

4.3.5 RS-232 Port

The RS-232 connections made to the rear panel of the 808 connector (J5) and switches S1 and S2, are routed to the communication board through 40-pin connector J2. The selector board (see schematic diagram of figure 7-5) contains switches S1 and S2, along with the modem jack (modem jack applies to Option 106 only). The input and output voltage

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levels of the RS-232 port from this connector are then shifted to the processor's voltage levels using U23, U24, and U25. When using this port, the processor disables the modem section of the board by setting specific latches of U21. The outputs of these latches are then used to disable the modem IC, U81, and also to open relay U84. Data then runs to and from the processor using the RS-232 port with its associated control lines.

4.3.6 Modem (Option 106 ONLY)

The modem section of the communication board makes its connections to J6 via 40-pin connector J2. The processor disables the RS-232 port by setting RTS to a false state, and then proceeds to send data to to modem IC U81. This IC interfaces the serial data to the telephone line by creating or receiving the correct mark-space frequencies. U81, U82, and U83 interface the communication board to the telephone line.

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SECTION V

MAINTENANCE AND CALIBRATION

5.1 GENERAL

In general, neither Option 105 nor Option 106 requires user maintenance or calibration. On Option 106, however, however, if the setting of potentiometer R82 is somehow altered, Option 106 will have to be recalibrated. Recalibration should be performed ONLY by qualified Dranetz service personnel. Contact the Dranetz Customer Service Department for further details.

Tel. No. (201) 287-3680 TWX: (710) 997-9553

TELEX: 499-7808 CABLE: DRANETZ

5.2 808 DISASSEMBLY PROCEDURE

The following subparagraphs are provided for reference purposes and are intended for use only by Dranetz technical personnel.

WARNING

These instructions are intended for qualified personnel ONLY. To avoid electrical shock, DO NOT perform any procedures other than those contained in your Operator's manual unless you are qualified to do so.

DO NOT attempt any internal adjustments unless another person, capable of rendering aid and resuscitation, is present.

Read Instructions Carefully

Because of possible shock ot fire hazard, DO NOT perform any tasks which are beyond your qualifications. Your qualifications for performing such tasks should be self-determined.

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CAUTION

For Option 106, DO NOT attempt to adjust the modem section. Any adjustment to this section should ONLY be made by qualified Dranetz service personnel.

5.2.1 Equipment Required for 808 Disassembly

An extender cable, Dranetz part number 110610, is the only piece of equipment required. This cable consists of a 34-conductor ribbon cable which is 14 inches long and fitted with an AMP connector (P/N 88393-6) at each end.

WARNING

Read instructions carefully and be sure to turn off the 808 unit and unplug its power cord before attempting disassembly.

5.2.2 Disassembly

(1) Remove the four black screws, two on each side, and the two small rubber feet from the top of the unit.

(2) Remove the case top.

(3) Remove the two white retaining blocks, taking note of their direction, and then loosen the bracing bar so that the sides of the case open slightly.

(4) Remove the key shaft by compressing the two retention springs around it.

(5) Remove the ribbon cables from the large boards.

(6) Remove the nylon screw from the upper left corner of the 808's rear panel.

(7) Carefully remove the front panel and the first board (A2) together. Since the two boards will still be connected together, take care not to break the flex cable at the bottom. As you pull out the boards, disconnect the battery connector from connector J6 of Main Processor board A2. Place the attached front panel and main processor on a work bench.

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(8) Remove the communication board and place it on the bench.

(9) Unscrew the small rubber feet near the bottom of the rear panel.

(10) Remove the rear panel and Analog board A3 together. Temporarily place the analog board aside.

(11) With the rear panel still connected to the battery pack of the 808, remove the four screws from the bottom of the case which secure the pack.

(12) Reassemble the unit outside of its case on the bench as illustrated in figure 5-1. Reattach the connectors to each of the boards except the analog board. Replace the 3-connector ribbon cable with the extender cable.

5.2.3 Reassembly

Reassembly of the 808 is essentially the reverse procedure of its assembly.

(1) Disassemble the layed-out 808 unit on the bench.

(2) Disconnect the board connectors and replace the extender cable with the ribbon cable.

(3) Attach the four screws to the bottom of the case in order to resecure the battery pack.

(4) Simultaneously insert the rear panel and analog board.

(5) Reattach the rubber feet to the bottom of the unit.

(6) Insert the communication board.

(7) Reconnect the battery connector to connector J6 of the main processor board.

(8) Simultaneously insert the front panel and the first board (A2).

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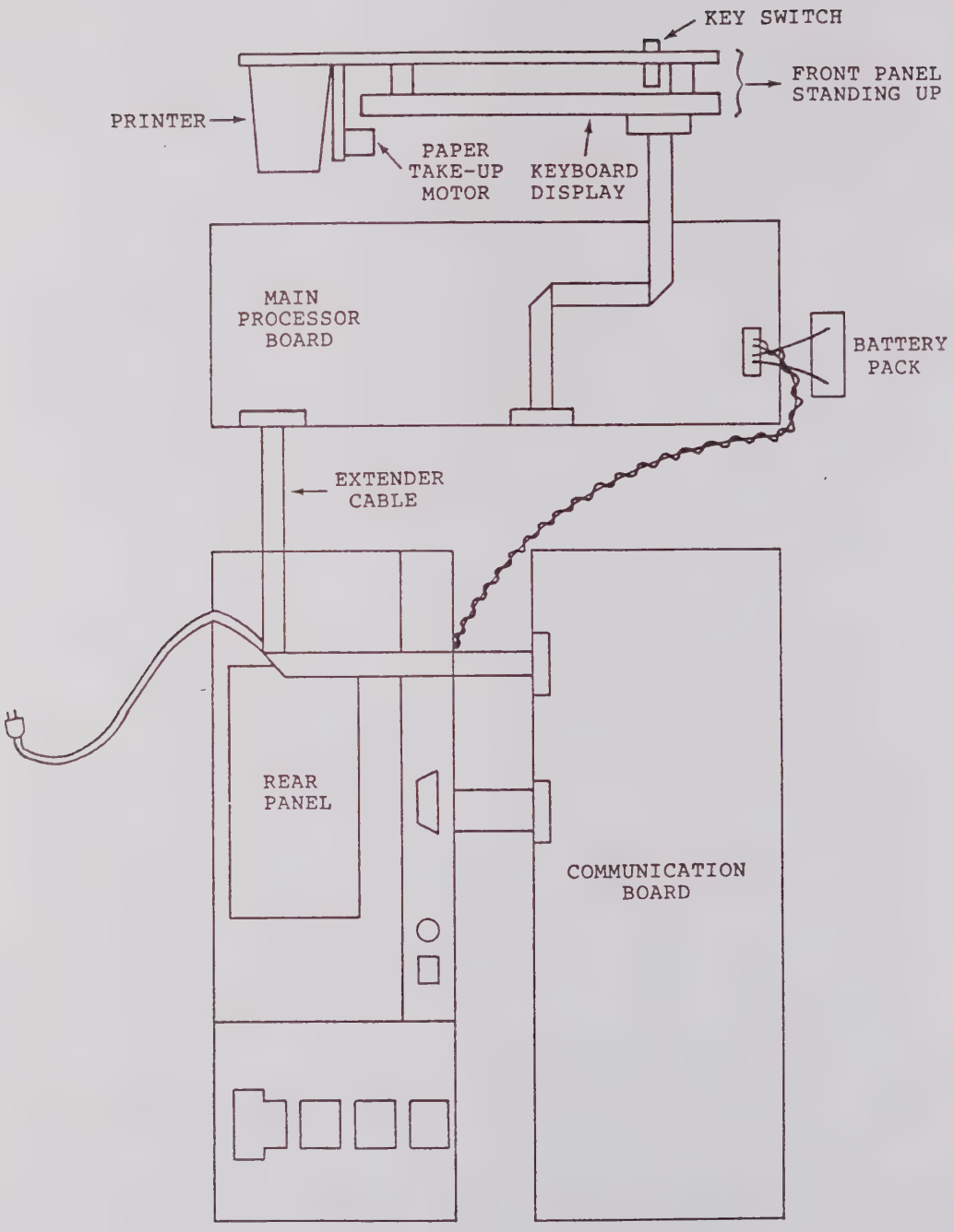

Figure 5-1. Top View of Disassembled 808 Unit on Test Bench

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(9) Reattach the nylon screw to the upper left corner of the 808 rear panel.

(10) Reconnect the ribbon cables to the large boards.

(11) Reconnect the key shaft.

(12) Tighten the bracing bar so that the sides of the case close.

(13) Reattach the two white retaining blocks in the same direction as noted when they were disconnected.

(14) Reattach the case top, two small rubber feet on the bottom of the unit, and the four black screws.

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SECTION VI

REPLACEABLE PARTS LIST

6.1 INTRODUCTION

This Replaceable Parts List identifies all maintenance parts in the Communication Interface (Options 105/106) for the 808. For each part, the reference designation (if applicable) is shown, along with the part number, manufacturer's code number and description. All maintenance parts are shown in the assembly drawings included in Section VII.

6.2 MANUFACTURERS' CODES

The manufacturers' codes in this parts list are identified below:

00779	Amp, Inc. P.O. Box 3608 Harrisburg, PA 17105
06540	Amatom Electronic Hardware Co., Inc. 446 Blake Street New Haven, CT 06515
23207	Dranetz Technologies, Inc 1000 New Durham Road Edison, N.J. 08818

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REPLACEABLE PARTS LIST

OPTION 105, P/N 111310-G1

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
A6	111300-G1	23207	Communication Board
A7	111311-G1	23207	Selector Board
	111306	23207	Interface Cable Assy
	110611-G2	23207	Analog Cable Assy
	102714-G2	23207	Paper Roll (4)
	111309	23207	Modem Cover

OPTION 106, P/N 111310-G2

A6	111300-G2	23207	Communication Board
A7	11311-G2	23207	Selector Board
	111306	23207	Interface Cable Assy
	110611-G2	23207	Analog Cable Assy
	111024-G1	23207	Modular Plug Cable Assy, Double Ended
	102714-G2	23207	Paper Roll (4)
	111607	23207	Program Plug Assy

SELECTOR BOARD, P/N 111311-G( )

J1*	520258-2	00779	Modular Jack, 4-Contact
J2*	110749-G2	23207	IC Socket, 14-Pin
R1*,R2*	RCR20G150J	81349	Res, 15 ohms, 5%, 1/2W
RV1*	110748-G3	23207	Varistor
S1	104832	23207	Dual In-line Rocker Switch

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REPLACEABLE PARTS LIST

COMMUNICATION BOARD A6, P/N 111300-G( )

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
BR81*	104433-G2	23207	Diode Bridge
BT1	110731	23207	Battery, Nicad
C1,C2,C5-C7	103209-G2	23207	Cap, 0.22 uf, 20%, 50V
C3,C4,C81*, C82*	104016-G4	23207	Cap, 20 pf, 5%, 500V
C8,C10,C13, C15-C17,C19-C23,(C88-C90)*	103208-G4	23207	Cap, 0.1 uf, 20%, 50V
C9,C56*,C87*	103209-G3	23207	Cap, 0.47 uf, 20%, 50V
C24-C27	104022-G4	23207	Cap, 200 pf, 5%, 500V
C80*	104123-G1	23207	Cap, 0.1 uf, 10%, 100V
C83*	104123-G2	23207	Cap, 0.22 uf, 10%, 100V
C84*	103209-G4	23207	Cap, .047 uf, 20%, 100V
C85*	104124-G1	23207	Cap, 0.1 uf, 10%, 250V
C86*	104124-G2	23207	Cap, 0.47 uf, 10%, 250V
C91*	103208-G1	23207	Cap, .01 uf, 20%, 50V
CR1,CR82*	104412-G2	23207	Diode, High Speed Switching
CR3	102899	23207	Diode, Hot Carrier
(CR4,CR5)*	104403-G3	23207	Diode, Zener, 5.1V
CR81*	104429-G2	23207	Diode, Zener
CRN1	104340	23207	Diode Network

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REPLACEABLE PARTS LIST

COMMUNICATION BOARD A6, P/N 111300-G( ) (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
J1	102160-8	00779	Conn., 34-Pin Rt Angle
J2	102160-9	00779	Conn., 40-Pin Rt Angle
Used @ J1,J2	102312-2	00779	Latch (4)
Q1,Q81*	104505	23207	Transistor
R1,R90*	RCR07G103J	81349	Res, 10K, 5%, 1/4W
R2	RCR07G513J	81349	Res, 51K, 5%, 1/4W
R3	RCR07G105J	81349	Res, 1 Meg, 5%, 1/4W
R4-R8,R15, R16	RCR07G104J	81349	Res, 100K, 5%, 1/4W
R9, R88*	RCR07G393J	81349	Res, 39K, 5%, 1/4W
R10, R81*, R89*	RCR07G203J	81349	Res, 20K, 5%, 1/4W
R11,R86*	RCR07G102J	81349	Res, 1K, 5%, 1/4W
R12-R14	RCR07G271J	81349	Res, 270 ohms, 5%, 1/4W
R17**	RCR07G471J	81349	Res, 470 ohms, 5%, 1/4W
R82*	104701-G2	23207	Res, Var, 20K, 10%, 1/2W
R83*	RCR20G621J	81349	Res, 620 ohms, 5%, 1/2W
(R84,R85)*	RN55C1002F	81349	Res, 10K, 1%, 1/10W
R87*	RCR07G625J	81349	Res, 6.2 Meg, 5%, 1/4W
R91*	RCR32G153J	81349	Res, 15K, 5%, 1W
R92*	RCR07G330J	81349	Res, 33 ohms, 5%, 1/4W

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**Option 105 only.

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REPLACEABLE PARTS LIST

COMMUNICATION BOARD A6, P/N 111300-G( ) (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R93*	RCR07G682J	81349	Res, 6.8K, 5%, 1/4W
R94*	RCR07G273J	81349	Res, 27K, 5%, 1/4W
R95*	RCR07G391K	81349	Res, 390 ohms, 5%, 1/4W
R96	RN55C4991F	81349	Res, 4.99K, 1%, 1/10W
RN1	104756	23207	Res Network, 10K, 10%
T81*	104652	23207	Transformer
U1	104269-G1	23207	IC, Microprocessor, CMOS
U2	104271-G2	23207	IC, Octal Latch
U3	112034-G4	23207	IC, RAM, CMOS, 32K x 8 Mono
U10	See Program Listing 105910	23207	PROM
U11,U14,U17	104392-G1	23207	IC, Quad NAND Gate, CMOS
U12	104271-G4	23207	IC, Decoder, CMOS
U13	104271-G3	23207	IC, Decoder, CMOS
U15	104271-G1	23207	IC, Triple OR Gate, CMOS
U16	104232-G1	23207	IC, Quad OR Gate, CMOS

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REPLACEABLE PARTS LIST

COMMUNICATION BOARD A6, P/N 111300-G( ) (CONT'D)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
U18	104231-G3	23207	IC, Dual "D" Flip-Flop
U19,U20	104225-G5	23207	IC, Octal Buffer
U21,U22	104225-G6	23207	IC, Octal Flip-Flop
U23	104203-G2	23207	IC, Hex Inv Buffer
U24,U25, U82*	104236-G1	23207	IC, Dual Op Amp
U81*	104274-G1	23207	IC, Modem
U83*	104333	23207	IC, Opto Isolator
U84*	104299-G1	23207	IC, Solid State Relay
XU1	110749-G9	23207	IC Socket, 40 Pin
XU3	110749-G8	23207	IC Socket, 28 Pin
XU81*	110749-G4	23207	IC Socket, 18 Pin
XU8-XU10	110749-G7	23207	IC Socket, 24 Pin
Y1	110729-G1	23207	Crystal, 4.9152 MHz
Y81*	110729-G2	23207	Crystal, 4.032 MHz

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SECTION VII

SCHEMATIC DIAGRAMS AND ASSEMBLY DRAWINGS

The drawings in this section contain the schematic and wiring diagrams as well as the assembly drawings of the equipment comprising the Series 808 Electric Communication Interface Options 105 and 106. The schematic and wiring diagrams supplement the Theory of Operation and Maintenance sections (IV and V, respectively) of this manual. The assembly drawings illustrate and locate the parts referenced in the Replaceable Parts List (Section VI).

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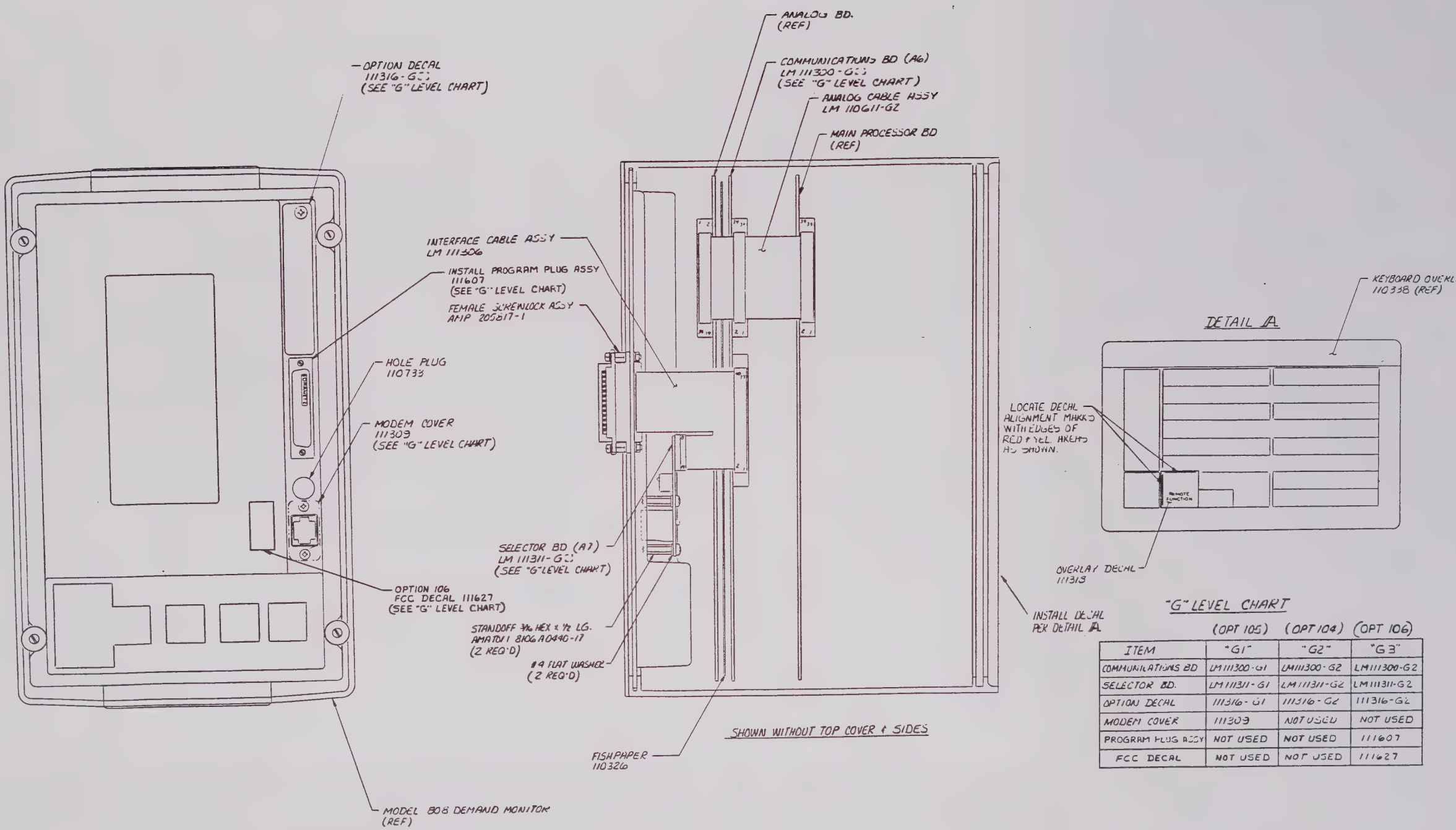

"G" LEVEL CHART

ITEM	(OPT 105) "G1"	(OPT 104) "G2"	(OPT 106) "G3"
COMMUNICATIONS BD	LM111300-G1	LM111300-G2	LM111300-G2
SELECTOR BD.	LM111311-G1	LM111311-G2	LM111311-G2
OPTION DECAL	111316-G1	111316-G2	111316-G2
MODEM COVER	111303	NOT USED	NOT USED
PROGRAM PLUG ASSY	NOT USED	NOT USED	111607
FCC DECAL	NOT USED	NOT USED	111627

Figure 7-1. Option 104/105/106 Assembly, P/N 111310-G( ), Rev. C

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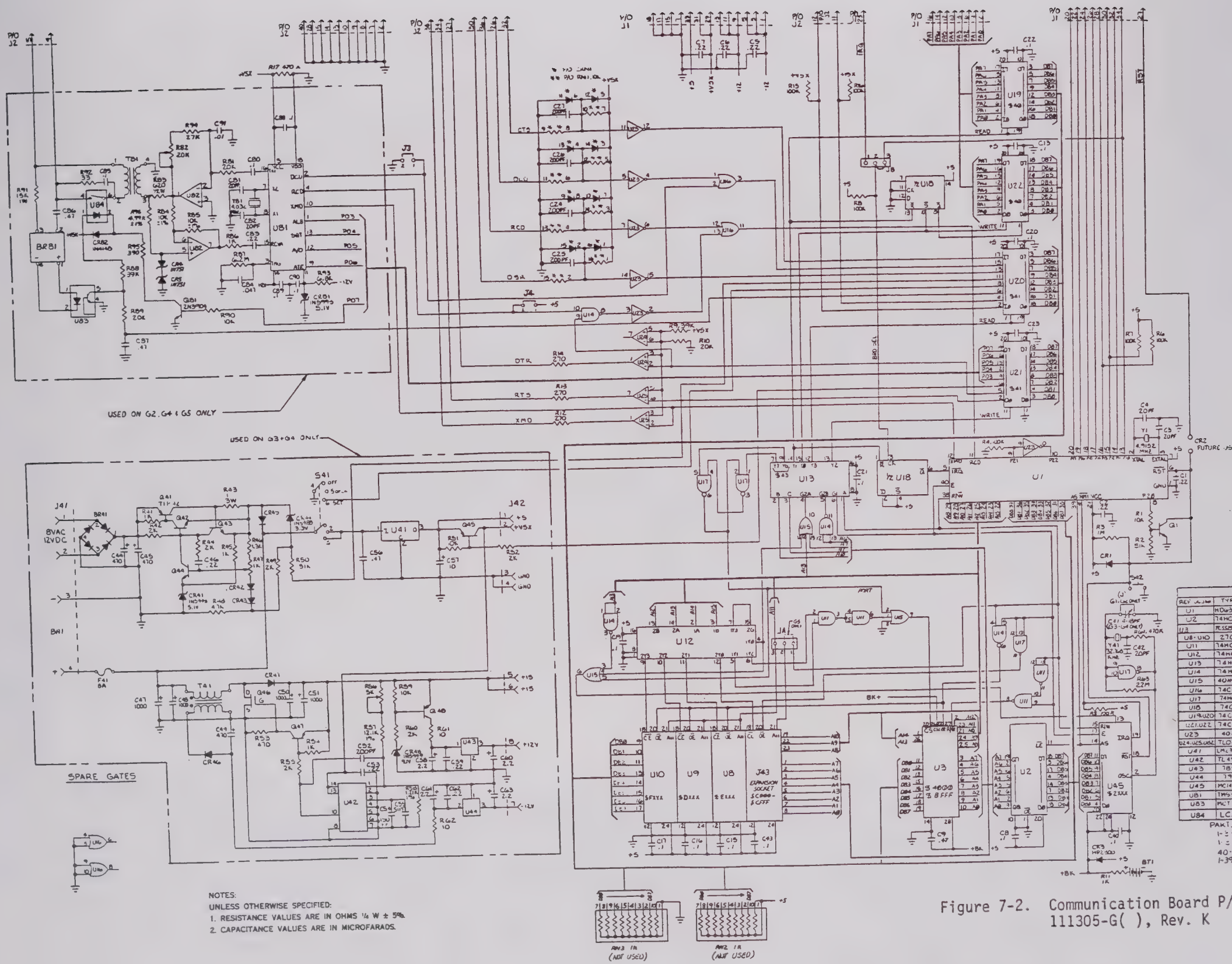
USED ON G2.G4 & G5 ONLY
USED ON G3+G4 ONLY
SPARE GATES
8VAC 12VDC
BR41
BA1
F41 8A
J41
J42
S41
T41
U41
U42
U43
U49
CR41
CR42
CR43
CR44
CR45
CR46
CR47
CR48
Q41
Q42
Q43
Q44
Q45
Q46
Q47
Q48
+12V
-12V
+5
+5VX
GND
DTR
RTS
XMO
RCD
DSR
DCD
RI
CTS
TBI
U81
U82
U83
U84
BRBI
U10
U9
U8
J43
EXPANSION SOCKET $C000-$CFFF
U12
U13
U18
U19
U22
U20
U21
U23
U1
U2
U3
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
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U21
U22
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U41
U42
U43
U44
U45
U81
U83
U84
J1
J2
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J4
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J40

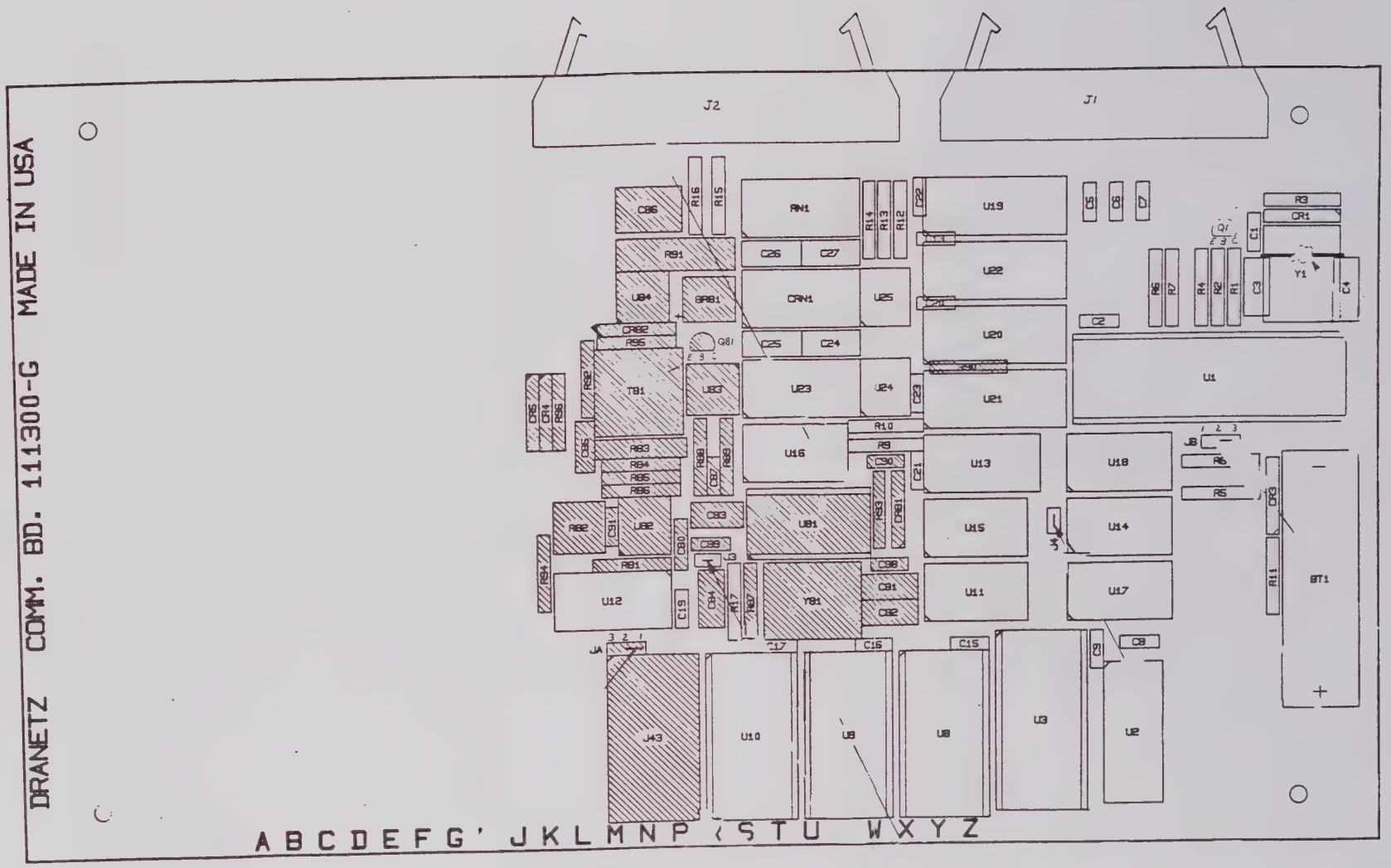

Figure 7-3. Communication Board Assembly, P/N 111300-G( ), Rev. K

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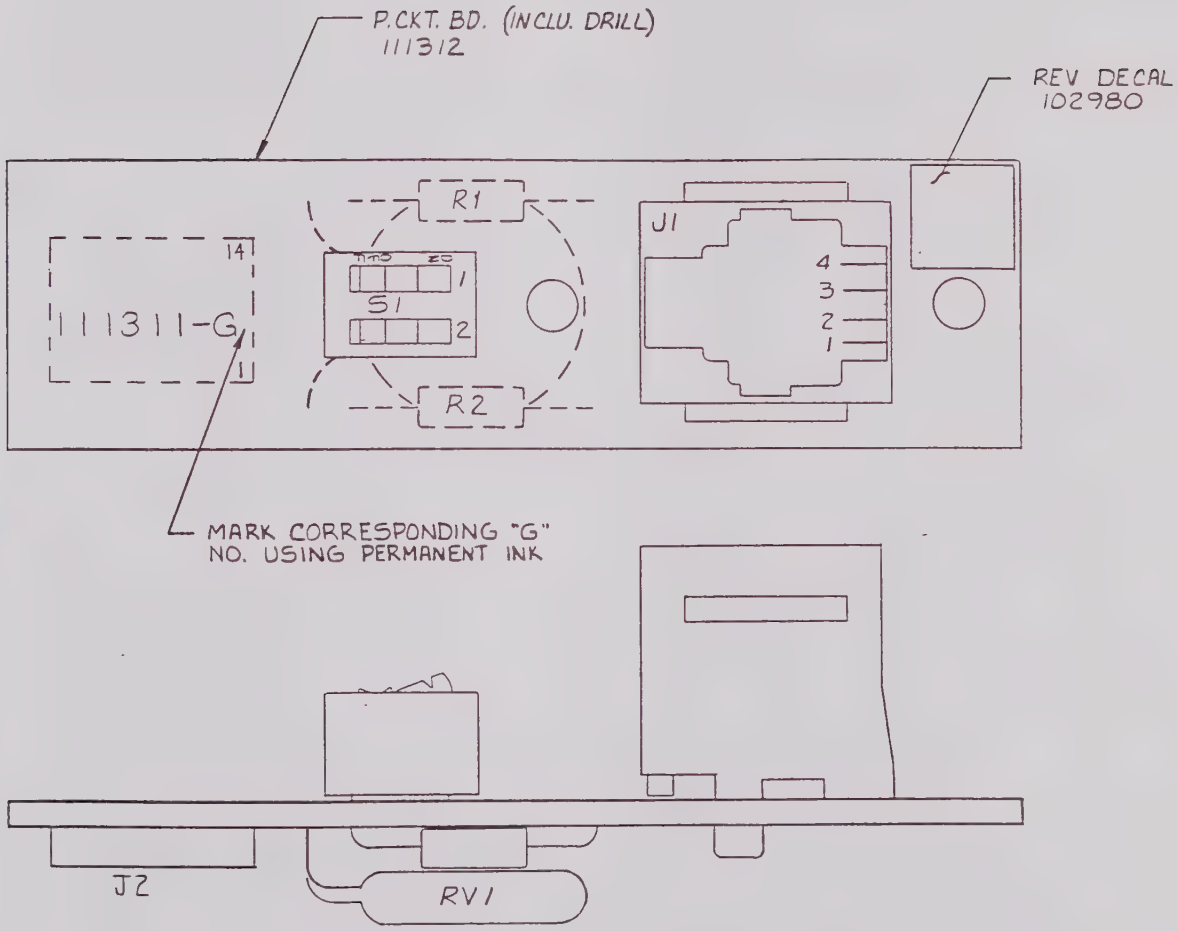

Note: R1, R2, RV2, J1, and J2 are not used with Option 105.

Fig 7-4. Selector Board Parts Locations, 111311-G[], Rev C

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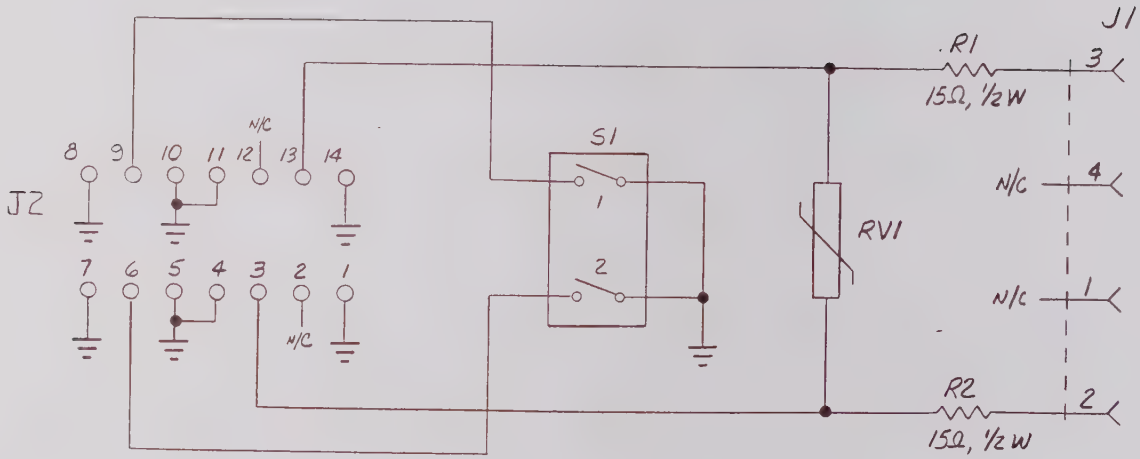

Note: R1, R2, RV1, J1, and J2 are not used with Option 105.

Fig 7-5. Selector Board Schematic, P/N 111311-G[], Schem 111315-G[], Rev C

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REPAIR/SERVICE ORDER FORM

IMPORTANT: Enclose this form with returned equipment (see other side for instructions)

DRANETZ TECHNOLOGIES, INC.
Customer Service Department
4 Gladys Court
Edison, New Jersey 08818

Tel: (201) 287-3680
FAX: (201) 248-9240

Ship to:_____

Reference/P.O.#_____
Invoice to:_____

EQUIPMENT BEING RETURNED

Model No._____ S/N_____ Model No._____ S/N_____
Model No._____ S/N_____ Model No._____ S/N_____
Model No._____ S/N_____ Model No._____ S/N_____

Accessory equipment also being returned (fill this out to assure return to you):
☐ Power & Other Cables_____ ☐ Instr. Book_____
☐ Other_____

RETURN AUTHORIZATION

If you have discussed the problem with Dranetz Sales or Service personnel, who did you speak with?_____
Dranetz Return Authorization No._____ By_____ Date_____
Who should Dranetz Customer Service contact for technical questions?

Name (please print) Department Telephone Number

DESCRIPTION OF THE PROBLEM

Reason for return: ☐ Defect ☐ Calibration ☐ Battery Replacement
Please provide a detailed description of the problem, including any test data results (service cannot be performed without this information). Attach additional sheets if necessary.

Check where applicable. Is the malfunction related to:
☐ Warm-up ☐ Temperature ☐ Intermittence ☐ Grounding
☐ Mechanical Handling ☐ Visual Defects ☐ Check if Test Data is Attached

INITIATOR OF THIS REPAIR/SERVICE ORDER

Name/Title (please print) Signature Telephone Number

INSTRUCTIONS FOR THE REPAIR/SERVICE ORDER

IMPORTANT: Follow all instructions and use this form to help us help you.

1. Before returning any equipment, call our Customer Service Dept. at (201) 287-3680. Give the service representative the model and serial numbers of your equipment, and any information regarding your problem.

   a. Our specialists may be able to solve your problem without need for equipment return.

   b. If equipment return is necessary, you will be supplied appropriate instructions and authorization information to expedite service.

2. If equipment return is necessary:

   a. Fill out the other side of this form **COMPLETELY**.

   b. Enclose this form inside the shipping carton. If possible, attach this form by masking tape to the equipment.

   c. Ship prepaid (including insurance); we will return prepaid unless you advise us otherwise.

   d. **IMPORTANT** - Pack properly! Dranetz Technologies, Inc. will not be liable for shipping damage.

NOTE:

Within the Continental United States, all material will be returned by Dranetz Technologies, Inc. to you by UPS, UPS Blue, UPS Red, or another carrier chosen by Dranetz unless we are instructed otherwise.

Warranty Information:

Statement of Warranty - All products of Dranetz Technologies, Inc. are warranted to the original purchaser against defective material and workmanship for a period of one year from the date of delivery. Dranetz will repair or replace, at its option, all defective material returned freight prepaid during the warranty period. There is no charge for this repair provided there is no evidence that the equipment has been mishandled or abused.

INSTRUCTIONS FOR THE REPAIR/SERVICE ORDER

IMPORTANT: Follow all instructions and use this form to help us help you.

1. Before returning any equipment, call our Customer Service Dept. at (201) 287-3680. Give the service representative the model and serial numbers of your equipment, and any information regarding your problem.

   a. Our specialists may be able to solve your problem without need for equipment return.

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